PA Consulting Group

State of Wisconsin Public Service Commission of Wisconsin

Focus on Energy Evaluation

Business Programs: Channel Studies—Fiscal Year 2008

Final Report: January 17, 2009

Evaluation Contractor: PA Consulting Group

Prepared by: Ryan Barry, Mimi Goldberg, Mitch Rosenberg, Joshua Horton, and Karen Rothkin; KEMA

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1. EXECUTIVE SUMMARY

1.1 OVERVIEW

The *Channel Studies—Fiscal Year 2008* report (*Channel Studies*) provides baseline estimates for the Focus on Energy Business Program market effect contract metrics and investigates other potential indicators of program market effects.

The program administrator's contract metrics are contractual requirements for the program administrator. The contract metrics have included both operational metrics that can be tracked by the program and verified by evaluation, and market effects metrics. On the operational side, evaluation's primary role is to verify gross savings tracked by the program. Other operational metrics are reported by the program based on their own tracking and are not verified by evaluation. Market effects metrics relate to program effects that are not directly tracked by the program. The attainment of contract market effect metrics provides an indication that the program is on track with its program theory. It is not an indication that there is additional energy savings beyond what is tracked by the program.

The program administrator is focusing on four specific technologies within its Channel Initiatives. The channels and selected technologies are shown in Table 1-1.

Table 1-1. Contract Metric Channel Technologies

Channel	Technology
Lighting	High bay fluorescent lighting systems
BP HVAC	High efficiency rooftop units
Rotary	VFD controlled compressed air systems
	VFD controlled industrial pumps and fans

KEMA estimated the contract metric baseline values and probed supply-side effects and other forms of spillover using the results of the surveys of key market actors in each channel under consideration. The rationale for the selection of each market actor is provided in Table 1-2.

Table 1-2. Market Actors Surveyed

Channel	Market Actor	Rationale for Selected Market Actor
Lighting	Lighting installation contractors	Contractors were selected because they are more knowledgeable than lighting distributors about where lamps are installed. In addition, contractors can provide better market-level data than can end-users.

Channel	Market Actor	Rationale for Selected Market Actor
BP HVAC	HVAC distributors	Distributors were chosen because they are particularly knowledgeable about rooftop unit (RTU) sales. In a typical year, HVAC contractors are not active enough to provide reliable market penetration estimates and for this reason were not selected as survey subjects.
Rotary	Industrial end users	Distributors are normally unaware of specific VFD applications. While vendors/contractors are more knowledgeable about VFD applications, they are a diverse group and difficult to identify. Only end-users are both knowledgeable about VFD applications and readily identifiable and were therefore selected for surveys.

1.2 METRIC RESULTS

Contract metrics were operationalized, measured, and compared for the Lighting, BP HVAC, and Rotary Channels. In what follows, the major findings regarding primary and supplementary metrics are presented.

1.2.1 LIGHTING CHANNEL METRIC

The program selected high-bay fluorescent lighting as the subject of the Lighting Channel market effect contract metric. The program has marketed and promoted high-bay fluorescent lighting for the past seven years and plans to continue these efforts. Program activities have included prescriptive incentives, training, and distribution of information. As shown in Table 1-3, the program contract defines the "critical metric" as follows, "Increase in net Wisconsin market share of high-bay fluorescent lighting systems across all market segments compared to any increase in net market share for Illinois baseline, and to standard HID technology." The evaluation developed indicators of this metric through a survey of electrical contractors who install commercial lighting.

Table 1-3. Lighting Contract Metric Baseline Approach

Channel	Critical Metric	Summary of Operational Definition
Lighting	Increase in net Wisconsin market share of high-bay fluorescent lighting systems, across all market segments, compared to any increase in net market share from Illinois baseline, and to standard HID technology.	% of projects installed high-bay lighting % of high-bay *recommended* fluorescent over HID % of high-bay *installed* fluorescent over HID

A. PRIMARY METRICS

Tables 1-4 and 1-5 present the metrics baselines estimates for Wisconsin and Illinois, respectively. Table 1-4 shows that, on average, contractors in Wisconsin installed high-bay lighting equipment in 28 percent of the commercial and industrial lighting projects completed

over the previous twelve months. Wisconsin lighting contractors recommended fluorescent as opposed to HID fixtures in an average 69 percent of these high-bay lighting projects, and actually installed fluorescent as opposed to HID fixtures in an average 72 percent of such projects.[1]

Table 1-4. Lighting Channel Metric Baselines: Wisconsin

Wisconsin					
				90% Confidence Interval	
Operational Definition	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of C&I lighting projects completed in past 12 months with high-bay lighting installation	60	28%	9.1%	12.9%	43.4%
Percent of high-bay lighting projects for which fluorescent as opposed to HID fixtures were recommended	59	69%	10.4%	52.0%	86.7%
Percent of high-bay lighting projects for which fluorescent as opposed to HID fixtures were installed	59	72%	9.0%	57.3%	87.3%

Table 1-5 indicates that Illinois contractors performed high-bay lighting installations in 25 percent of completed projects. Illinois firms recommended fluorescent fixtures in 51 percent of applicable projects. The rate of fluorescent fixture installation in Illinois was 28 percent.

Table 1-5. Lighting Channel Metric Baselines: Illinois

Illinois					
				90% Confidence Interval	
Operational Definition	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of C&I lighting projects completed in past 12 months with high-bay lighting installation	57	25%	4.5%	17.1%	32.0%
Percent of high-bay lighting projects for which fluorescent as opposed to HID fixtures were recommended	57	51%	11.5%	32.1%	70.7%
Percent of high-bay lighting projects for which fluorescent as opposed to HID fixtures were installed	57	28%	9.2%	12.4%	43.2%

While contract metric baseline values for high-bay lighting installation rates and fluorescent fixture recommendation rates were comparable in Wisconsin and Illinois, baseline values for fluorescent fixture installation rates differed significantly. Specifically, the difference between the states' fluorescent fixture installation rates, with Wisconsin contractors installing efficient fixtures at a 44-percentage-point higher level than Illinois contractors, was statistically significant at the one-percent level (p-value = 0.0005). This stands as strong evidence that fluorescent lighting systems account for a substantially larger share of the high-bay lighting market in Wisconsin than in Illinois. Given that the existence of the Business Programs is one of the major differences between these two markets, it is reasonable to infer that Focus on Energy is at least partially responsible for the higher market share of high-bay fluorescent fixtures in Wisconsin.

[1] Installation rates may surpass recommendation rates in cases where customers instruct lighting contractors to install efficient equipment without having received a contractor recommendation.

B. SUPPLEMENTARY METRICS

The evaluation team also sought information on the portion of total C&I projects in which the following efficient lighting technologies were recommended and installed high performance T8 systems, T5 lighting technology, occupancy sensors, and automatic daylighting controls.

Table 1-6 and Table 1-7 show the supplemental lighting metric baseline results for Wisconsin and Illinois, respectively. In Wisconsin, high performance T-8 systems were recommended in an average 60 percent of lighting projects completed over the previous year, and T-8 systems were installed an average 60 percent of recommended projects.[2] T-5 technology was recommended in an average 20 percent of projects and actually installed in an average 14 percent of recommended projects. Occupancy controls were recommended in an average 61 percent of Wisconsin projects, and installed in 69 percent of them. Automatic daylighting controls were recommended in an average 15 percent of Wisconsin lighting projects and installed in 19 percent of recommended projects.

Table 1-6. Supplemental Lighting Metric Baselines: Wisconsin

Wisconsin						
					90% Confidence Interval	
Supplemental Lighting Metrics	Technology	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of C&I lighting projects completed in past 12 months the contractor recommeded or specified…	High performance T-8 Systems as defined by CEE	60	60%	4.9%	51.6%	67.9%
	T-5 Lighting technology	58	20%	2.9%	14.8%	24.5%
	Occupancy controls	60	61%	6.8%	49.3%	72.0%
	Automatic daylighting controls	60	15%	5.1%	6.7%	23.8%
Percent of C&I lighting projects completed in past 12 months the contractor installed…	High performance T-8 Systems as defined by CEE	60	60%	5.6%	51.0%	69.7%
	T-5 Lighting technology	58	14%	5.2%	5.0%	22.6%
	Occupancy controls	60	69%	10.6%	51.5%	86.9%
	Automatic daylighting controls	59	19%	7.1%	7.5%	31.3%

In Illinois, contractors recommended T-8 systems in 58 percent of projects and installed them in 68 percent of recommended projects. T-5 technology was recommended in an average 32 percent of lighting projects, and installed in an average 41 percent of recommended projects. Illinois contractors recommended occupancy controls in 21 percent of lighting projects and daylighting controls in 16 percent of them, and installed these two technologies in 22 percent and 14 percent of recommended projects, respectively.

Table 1-7. Supplemental Lighting Metric Baselines: Illinois

Illinois						
					90% Confidence Interval	
Supplemental Lighting Metrics	Technology	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of C&I lighting projects completed in past 12 months the contractor recommeded or specified…	High performance T-8 Systems as defined by CEE	59	58%	7.8%	45%	71%
	T-5 Lighting technology	58	32%	12.3%	11%	52%
	Occupancy controls	57	21%	3.6%	15%	27%
	Automatic daylighting controls	57	16%	5.8%	6%	26%
Percent of C&I lighting projects completed in past 12 months the contractor installed…	High performance T-8 Systems as defined by CEE	58	68%	6.7%	57%	79%
	T-5 Lighting technology	56	41%	10.6%	24%	59%
	Occupancy controls	57	22%	6.1%	11%	32%
	Automatic daylighting controls	58	14%	6.4%	3%	25%

[2] For supplementary metrics, recommendation rates represent the percentage of total projects completed over the previous year for which high-efficiency technology was recommended, while installation rates refer to the percentage of *recommended* projects in which high-efficiency equipment was actually installed. Installation rates *do not* refer to the percentage of *total* projects in which high-efficiency equipment was installed. For this reason, installation rates may be higher than recommendation rates.

Differences in recommendation rates between Wisconsin and Illinois for high-performance T-8 systems, T-5 technology, and automatic daylighting controls were not statistically significant. However, the difference in occupancy control recommendation rates between Wisconsin and Illinois, measured at 60 percent and 21 percent, respectively, was statistically significant at the one-percent level (p-value < 0.0001). Similarly, the difference in occupancy control installation rates between the two states, measured at 69 percent in Wisconsin and 22 percent in Illinois, was statistically significant at the one-percent level (p = 0.0001). Differences in high-performance T-8 system installation levels and daylighting control installation levels were not significant. Illinois lighting contractors installed T-5 technology at a rate of 41 percent compared to 14 percent for Wisconsin contractors.

1.2.2 BP HVAC METRIC

The program selected high efficiency rooftop units as the subject of the BP HVAC Channel market effect contract metric. The program has promoted this technology for many years through prescriptive incentives, training, and the distribution of information. The program decided to intensify its promotion of this technology in FY08 with two important changes. The program tripled the incentive and transferred the focus of its marketing efforts to promote the technology from the end-use customers to the trade allies. As shown in Table 1-8 the program contract defines the "critical metric" as follows, "Increase in net Wisconsin market share of high efficiency rooftop units in commercial, school, and government buildings, in comparison to increase in net market share from [the] Illinois baseline."

Table 1-8. HVAC Contract Metric Baseline Approach

Channel	Critical Metric	Summary of Operational Definition
BP HVAC	Increase in net Wisconsin market share of high efficiency rooftop units in commercial, school and government buildings, in comparison to increase in net market share from Illinois baseline.	% of packaged commercial rooftop HVAC units sold that meet program efficiency standards

A. PRIMARY METRICS

Tables 1-9 and 1-10 present the metric baseline estimates for Wisconsin and Illinois, respectively. In Wisconsin, for rooftop units smaller than 65 MBh/5.4 tons, 62 percent of units sold met program efficiency standards. For units between 65 MBh/5.4 tons and 134 MBh/11.25 tons, 41 percent of sales met program efficiency standards. For units between 135 MBh/11.25 tons and 239 MBh/20 tons, 36 percent of units sold met program efficiency standards, and for units between 240 MBh/20 tons and 749 MBh/62.4 tons, 29 percent of sales met program efficiency standards.

Table 1-9. BP HVAC Channel Metric Baselines: Wisconsin

Wisconsin						
					90% Confidence Interval	
Operational Definition	Size Category/ Efficiency Rating	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of sold units that meet program efficiency standards.	<65 MBh or <5.4 tons (11.6 EER or higher)	24	62%	9.2%	46.2%	77.7%
	65 - 134 MBh or 5.4 - 11.25 tons (11.5 EER or higher)	22	41%	9.1%	25.3%	56.7%
	135 - 239 MBh or 11.25 - 20 tons (11.5 EER or higher)	19	36%	4.5%	27.9%	43.3%
	240 - 749 MBh or 20 - 62.4 tons (10.5 EER or higher)	11	29%	7.4%	16.0%	42.6%

In Illinois, for rooftop units smaller than 65 MBh/5.4 tons, 38 percent of units sold met program efficiency standards. For units between 65 MBh/5.4 tons and 134 MBh/11.25 tons,

27 percent of sales met program efficiency standards. Likewise, 27 percent of units sold between 135 MBh/11.25 tons and 239 MBh/20 tons met program efficiency standards, and 32 percent of units sold between 240 MBh/20 tons and 749 MBh/62.4 tons met program efficiency standards.

Table 1-10. BPHVAC Channel Metric Baselines: Illinois

Illinois						
					90% Confidence Interval	
Operational Definition	Size Category/ Efficiency Rating	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of sold units that meet program efficiency standards.	<65 MBh or <5.4 tons (11.6 EER or higher)	25	38%	10.0%	20.9%	55.2%
	65 - 134 MBh or 5.4 - 11.25 tons (11.5 EER or higher)	23	27%	8.4%	13.0%	41.6%
	135 - 239 MBh or 11.25 - 20 tons (11.5 EER or higher)	19	27%	8.5%	12.5%	42.0%
	240 - 749 MBh or 20 - 62.4 tons (10.5 EER or higher)	9	32%	12.1%	10.1%	54.3%

Although the baseline values for Wisconsin reported above were higher than Illinois for three of the four size categories, only one was significant at the ten percent level. The share of high-efficiency sales for the smallest size category, units less than 65 MBh/5.4 tons, was statistically larger in Wisconsin compared to Illinois, at the five percent level (p-value = 0.0463). Models in this size category meet an Energy Efficiency Rating (EER) of 11.6 or greater sold at a 24-percentage-point higher rate in Wisconsin compared to Illinois.

B. SUPPLEMENTARY METRICS

The evaluation also estimated the market share of other efficient HVAC technologies for use in developing supplementary metrics of program effects. Specifically, the evaluation team sought information on the portion of rooftop units sold fitted with dual enthalpy economizers and with demand control ventilation with CO_2 sensors.

Table 1-11 and Table 1-12 show the supplemental BP HVAC metric baseline results for Wisconsin and Illinois, respectively. In Wisconsin, 55 percent of rooftop HVAC units sold in the past 12 months were fitted with dual enthalpy economizers. Likewise, 54 percent of units sold in Wisconsin were fitted with CO_2 sensors and demand control ventilation systems.

Table 1-11. Supplemental BP HVAC Metric Baselines: Wisconsin

Wisconsin					
				90% Confidence Interval	
Supplemental HVAC Metrics	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of units sold in past 12 months fitted with dual enthalpy economizers.	23	55%	13.4%	32.3%	78.2%
Percent of units sold in past 12 months fitted with CO2 sensors and demand control ventilation systems.	20	54%	12.4%	32.7%	75.5%

In Illinois, 41 percent of units sold were equipped with dual enthalpy economizers. Only 27 percent of HVAC units sold in Illinois were fitted with CO_2 sensors and demand control ventilation systems.

Table 1-12. Supplemental BP HVAC Metric Baselines: Illinois

Illinois					
				90% Confidence Interval	
Supplemental HVAC Metrics	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of units sold in past 12 months fitted with dual enthalpy economizers.	25	41%	11.2%	21.9%	60.2%
Percent of units sold in past 12 months fitted with CO2 sensors and demand control ventilation systems.	25	27%	6.9%	14.9%	38.6%

Although a higher percentage of units sold in Wisconsin were fitted with dual enthalpy economizers, the difference was not statistically significant. However, the 27-percentage-point higher proportion of CO_2 sensor/demand control ventilation system sales in Wisconsin relative to Illinois was significant at the five-percent level (p-value = 0.0343).

1.2.3 ROTARY METRICS

The program selected VFDs as the subject of the Rotary Channel market effects metrics. The program has promoted this technology through custom incentives, training, and the distribution of information since program inception. In FY07, the program started offering prescriptive incentives for VFD controlled compressed air systems and VFD controlled industrial pumps and fans systems. The *Channel Studies* examined industrial customer adoptions of VFDs in compressed air systems and in pump and fan systems. Table 1-13 shows the critical metrics as they appear in the contract along with a summary of the operational definitions of these metrics.

Table 1-13. Rotary Contract Metric Baseline Approach

Channel	Critical Metric	Summary of Operational Definition
Rotary	Increase in net Wisconsin market share of VFD controlled compressed air systems, compared to increase in net market share from Illinois baseline.	% of compressed air systems controlled by VFDs.
	Increase in net Wisconsin market share of VFD controlled industrial pump and fan flows, compared to increase in net market share from Illinois baseline.	% of fans and blowers controlled by VFDs. % of pumps controlled by VFDs.

Establishing metric baselines for the Rotary Channel proved to be a particularly challenging endeavor, given several aspects peculiar to the market for variable frequency drives (VFDs). First, in contrast to the Lighting and BP HVAC Channels, two distinct contract metrics, one for compressed air systems and the other for industrial pumps and fans, were selected for baseline measurement. Second, from an early stage, the evaluation team recognized that important differences distinguished pump applications from fan applications, so that it was necessary to assess VFD use separately for each of these technologies. In essence, three different VFD applications, for compressed air systems, pumps, and fans, merited investigation, and measuring baseline values for each application required unique calculations and methodological refinements.

Third, due both to the relative importance of the stock of VFD-eligible systems compared to the flow of such systems, and to the projected low incidence of large compressed air systems in Wisconsin and Illinois, the evaluation team gathered additional data on VFD saturation levels for all production motor applications in order to develop a more complete sense of VFD market share. This supplementary metric entailed its own unique methodological approach.

Despite these complications, data were collected and baseline values estimated for a total four metrics (compressed air systems, industrial fans, industrial pumps, overall VFD saturation levels). The baseline values are provided for each of these VFD applications.

A. COMPRESSED AIR SYSTEMS

Table 1-14 presents the compressed air metrics baseline estimates for Wisconsin and Illinois. For Wisconsin, 18 percent of compressed air systems were fitted with VFDs. For Illinois, 13 percent of systems were fitted with VFDs. The relatively small sample obtained by the surveys, particularly in Illinois (n = 103), effectively precluded disaggregating the results in terms of horsepower size category. Instead, the evaluation team weighted compressors by horsepower in order to take account of size variation.

Table 1-14. Rotary Contract Metric Baseline:
VFDs in Compressed Air Systems

VFD Compressed Air Metric	State	n	Baseline Estimate	Standard Error	90% Confidence Interval	
					Lower Bound	Upper Bound
Percent of compressed air system hp fitted with VFDs	Wisconsin	170	18%	6.7%	6.4%	28.7%
	Illinois	103	13%	5.0%	4.8%	21.5%

The metric baselines for VFDs used in compressed air systems in Wisconsin and Illinois are similar. The percentage point difference between these two estimates is not statistically significant at the 10 percent level of significance.

B. INDUSTRIAL FANS

Tables 1-15 and 1-16 present fan/blower metrics baselines estimates for Wisconsin and Illinois, respectively. In Wisconsin, there is little variation in the fraction of fans and blowers fitted with VFDs. The baseline estimates range from six percent in the greater than 50 hp size category to 12 percent in the 6-20 hp and 21-50 hp size categories. The Illinois baselines range from two percent in the greater than 50 hp size category to 15 percent in the 6–20 hp size category.

Table 1-15. Rotary Contract Metric Baseline: Wisconsin
VFDs in Fan and Blower Systems

Wisconsin						
VFD Fan or Blower System Metric	Size Category	n	Baseline Estimate	Standard Error	90% Confidence Interval	
					Lower Bound	Upper Bound
Percent of fans and blowers fitted with VFDs	1 - 5 hp	99	7%	2.9%	1.9%	11.5%
	6 - 20 hp	100	12%	4.7%	4.3%	20.1%
	21 - 50 hp	97	12%	3.0%	6.7%	16.6%
	> 50 hp	96	6%	3.0%	1.3%	11.3%
	Total	101	8%	2.0%	4.4%	11.2%

Table 1-16. Rotary Contract Metric Baseline: Illinois
VFDs in Fan and Blower Systems

Illinois						
					90% Confidence Interval	
VFD Fan or Blower System Metric	Size Category	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of fans and blowers fitted with VFDs	1 - 5 hp	56	11%	8.0%	0.0%	24.5%
	6 - 20 hp	54	15%	7.3%	2.6%	27.1%
	21 - 50 hp	53	5%	5.0%	0.0%	13.7%
	> 50 hp	53	2%	2.3%	0.0%	6.3%
	Total	56	10%	4.7%	2.3%	18.0%

The metric baselines for VFDs used in fan and blower systems in Wisconsin and Illinois are similar. The baseline estimates for each size category and the total are not statistically different from each other at the 10 percent level of significance.

C. INDUSTRIAL PUMPS

Tables 1-17 and 1-18 present pump metrics baselines estimates for Wisconsin and Illinois, respectively. In Wisconsin, the fraction of pumps fitted with VFDs tends to be larger for the larger pump systems. Twenty-two percent of pumps in the 20–100 hp size category and over half of the pumps in the greater than 100 hp size category are fitted with VFDs. The Illinois baseline estimates have the opposite trend, with less than 1 percent of motors in the greater then 100 hp size category and 29 percent of the pumps in the 1–5 hp size categories.

Table 1-17. Rotary Contract Metric Baseline: Wisconsin
VFDs in Pump Systems

Wisconsin						
					90% Confidence Interval	
VFD Pump System Metric	Size Category	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of pumps fitted with VFDs	1 - 5 hp	94	8%	3.7%	2.2%	14.5%
	6 - 20 hp	94	18%	8.2%	4.7%	32.1%
	21 - 50 hp	92	10%	3.5%	4.1%	15.8%
	50 - 100 hp	92	22%	10.8%	3.5%	39.5%
	> 100 hp	92	52%	19.9%	19.4%	85.4%
	Total	94	15%	4.5%	7.4%	22.2%

Table 1-18. Rotary Contract Metric Baseline: Illinois
VFDs in Pump Systems

Illinois						
					90% Confidence Interval	
VFD Pump System Metric	Size Category	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of pumps fitted with VFDs	1 - 5 hp	67	29%	11.5%	9.6%	48.1%
	6 - 20 hp	65	10%	4.5%	3.0%	18.0%
	21 - 50 hp	65	7%	4.8%	0.0%	15.3%
	50 - 100 hp	65	5%	3.6%	0.0%	11.4%
	> 100 hp	65	0%	0.1%	0.0%	0.4%
	Total	67	16%	4.9%	7.4%	23.8%

The smallest and largest categories are statistically different from each other at least at the ten-percent level of significance. For the 1–5 hp size category, the Illinois baseline estimate is significantly larger, while for the 50–100 hp and the greater than 100 hp size categories the Wisconsin baseline estimates are significantly larger.

D. SUPPLEMENTARY METRICS

KEMA expanded the scope of the VFD metric assessment to develop a more complete sense of the market share for VFDs. The questionnaire included questions that collect VFD saturation levels for all production motor applications rather than limiting to current purchases or only compressed air, pump, and fan systems. The results of these questions were used to estimate baseline values for both Wisconsin and Illinois.

Tables 1-19 and 1-20 present Wisconsin metric baseline estimates for motors greater than 20 hp and less than 20 hp, respectively. In Wisconsin, 38 percent of motors between 21 hp and 50 hp were equipped with VFDs, 65 percent of motors 51–100 hp, 58 percent of motors 101–200 hp, and 44 percent of motors over 200 hp. With respect to variable loads, 76 percent of variable loads on motors 21–50 hp used VFDs. For motors 51–100 hp, 76 percent of variable loads used VFDs, for motors 101–200 hp, 72 percent of variable loads used VFDs, and for motors greater than 200 hp, 61 percent of variable loads were controlled by VFDs.

Table 1-19. Rotary Contract Metric Baseline: Wisconsin
VFD Saturation Levels (>20 hp)

Wisconsin						
					90% Confidence Interval	
VFD Saturation	Size Category	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of motors with VFDs.	21 - 50 hp	85	38%	5.0%	30.2%	46.7%
	51 - 100 hp	67	65%	11.7%	45.2%	84.3%
	101 - 200 hp	64	58%	9.0%	42.9%	72.9%
	>200 hp	36	44%	8.5%	29.8%	58.5%
Percent of variable loads with VFDs.	21 - 50 hp	86	76%	5.5%	66.5%	84.8%
	51 - 100 hp	67	84%	8.8%	69.7%	99.1%
	101 - 200 hp	64	72%	10.5%	54.0%	89.1%
	>200 hp	37	61%	10.6%	42.8%	78.5%

Table 1-20 shows Wisconsin saturation levels for motors smaller than 20 hp. Within this size category, 37 percent of motors drive variable loads, and 21 percent of motors used VFDs.

Table 1-20. Rotary Contract Metric Baseline: Wisconsin
VFD Saturation Levels (<20 hp)

Wisconsin					
				90% Confidence Interval	
VFD Saturation	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of 1 - 20 hp motors with variable loads	169	37%	13.4%	14.8%	59.2%
Percent of 1 - 20 hp motors with VFDs	129	21%	6.3%	10.3%	31.1%

Illinois VFD saturation levels for motors greater than 20 hp and less than 20 hp are detailed in Tables 1-21 and 1-22, respectively. For motors 21–50 hp, 35 percent of motors used VFDs. For motors 51–100 hp, 29 percent were controlled by VFDs, and for motors greater than 200 hp, 30 percent were controlled by VFDs. Less than one percent of motors between 101 hp and 200 hp were equipped with VFDs. With respect to variable loads, within the size category

21–50 hp, 71 percent of variable loads were equipped with VFDs. For motors 51–100 hp, 52 percent of variable loads used VFDs, for motors 101–200 hp, 25 percent of variable loads used VFDs, and for motors greater than 200 hp, 63 percent of variable loads used VFDs.

Table 1-21. Rotary Contract Metric Baseline: Illinois
VFD Saturation Levels (>20 hp)

Illinois						
					90% Confidence Interval	
VFD Saturation	Size Category	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of motors with VFDs.	21 - 50 hp	35	35%	13.6%	12.4%	58.2%
	51 - 100 hp	25	29%	4.4%	21.0%	36.1%
	101 - 200 hp	26	0%	0.3%	0.0%	0.8%
	>200 hp	15	30%	8.5%	15.3%	45.1%
Percent of variable loads with VFDs.	21 - 50 hp	35	71%	12.0%	50.8%	91.3%
	51 - 100 hp	28	52%	10.4%	34.3%	69.8%
	101 - 200 hp	28	25%	3.5%	19.4%	31.3%
	>200 hp	16	63%	18.5%	30.9%	95.6%

For Illinois motors smaller than 20 hp, 35 percent of motors drive variable loads, and 13 percent of motors used VFDs.

Table 1-22. Rotary Contract Metric Baseline: Illinois
VFD Saturation Levels (<20 hp)

Illinois					
				90% Confidence Interval	
VFD Saturation	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of 1 - 20 hp motors with variable loads	119	35%	3.1%	29.9%	40.1%
Percent of 1 - 20 hp motors with VFDs	87	13%	3.0%	8.4%	18.4%

With respect to motor VFD saturation levels, differences in metric values between Wisconsin and Illinois were not statistically significant either for motors between 21 hp and 50 hp, or for motors greater than 200 hp. However, for motors 51–100 hp, the 36-percentage-point higher saturation rate in Wisconsin compared to Illinois was significant at the one-percent level (p-value < 0.0041). Similarly, for motors 101–200 hp, a size category in which less than one percent of Illinois end-users fitted motors with VFDs, Wisconsin's saturation level of 58 percent was significantly higher at the one-percent level (p-value < 0.0001).

With respect to variable load saturation levels, differences between Wisconsin and Illinois in the smallest and largest size categories were again insignificant. But for size category 51–100 hp, Wisconsin's 32-percentage-point higher VFD saturation level was significant at the five-percent level (p-value = 0.0125). And for size category 101–200 hp, the 47-percentage-point difference between the states was significant at the one-percent level (p-value = 0.0001).

For motors smaller than 20 hp, neither the difference in saturation levels for motors with variable loads between Wisconsin and Illinois, nor the difference in saturation rates for motors with VFDs, was statistically significant at the ten-percent level of significance.

1.2.4 SUPPLY-SIDE EFFECTS

The transition to net savings goals from gross savings goals has increased the level of attention on net-to-gross adjustments. The PSC, the evaluation team, and the program

administrators continue to be motivated to provide a complete assessment of program accomplishments. Evaluation savings adjustments for effects of the program that are not tracked by the program must be considered along with adjustments for measures that would have been implemented without the program. To this end, KEMA added a secondary goal of the *Channel Studies* that was not included in the detailed evaluation plan. This goal is to assess the qualitative evidence to date that there are sizable additional program effects on the market that are not already being captured by the program tracking and current evaluation activities. The present study was intended to gather and assess preliminary data on indirect program effects, as a prelude to possible future elaboration of formal indicators. The purpose of this secondary effort is not to quantify potential program effects in terms of energy savings.

The Focus on Energy Evaluation Team recently produced a white paper titled, *Integrating Supply-Side Results with End-User Net-to-Gross Self Reports*[3]. This white paper lays out a decision matrix to assist evaluators, policymakers and program administrators in weighing the decision to pursue additional supply–side research for incorporation into end-user self-report based NTG analysis. As stated in the white paper, the decision whether to conduct additional research and develop indicators of supply-side effects should be guided by three key criteria:

1. The existence of a plausible, credible, and specific program theory predicting supply-side program effects, or some other sound logical or empirical basis for believing they are likely to exist.

2. Likelihood that predicted effects can be meaningfully assessed through empirical research.

3. Likelihood that the needed research can be performed at reasonable cost, relative to the available budget and likely impact.

The secondary goal of the *Channel Studies* focuses of the first of these three criteria. The results of the *Channel Studies* demonstrate that for each Channel the program has had an effect on the market for the technologies under consideration. Results for each channel are presented below.

A. LIGHTING CHANNEL EFFECTS

Results generally support the notion that Focus has affected the market for energy efficient lighting in Wisconsin. To take one example, results indicate that Wisconsin consumers take greater account of multiple lighting equipment characteristics when selecting technology to purchase than do Illinois consumers, as shown in Table 1-23. High awareness and participation levels provide a direct link between the differences in the energy efficient lighting markets of Wisconsin and Illinois and the Focus on Energy Program. Furthermore, we also concluded based on the survey responses that a large fraction of energy efficiency sales are likely to be untracked. Given these findings, KEMA concludes that indirect supply-side effects are likely to exist and recommends the PSC consider additional supply-side research.

[3] Ralph Prahl et al., *Focus on Energy Evaluation: Integrating Supply-Side Results With End-User Net-to-Gross Self-Reports,* Focus on Energy Evaluation, July 2, 2008.

Table 1-23. Importance of Lighting Equipment Characteristics to Customer Selection Decisions, on Scale of 1 (= not at all important) to 10 (= very important)

On a scale from 1 to 10 where 1 is not at all important and 10 is very important, how important do your commercial customers treat the following lighting equipment characteristics when making equipment selection decisions?	State						2-tailed test of significance	
	Wisconsin			Illinois				
	n	estimate (avg)	standard error	n	estimate (avg)	standard error	Sig @ 90%	p-value
Initial cost of ther equipment	59	7.7	0.20	58	7.3	0.52	No	0.3974
Costs of operation	59	7.8	0.27	58	6.1	0.56	Yes	0.0102
Total life cycle costs	59	7.1	0.20	58	6.0	0.59	Yes	0.0979
Quality of light	59	7.8	0.27	58	6.6	0.65	Yes	0.0959
Maintenance of lighting level	59	6.0	0.66	58	5.9	0.70	No	0.9013
Ease of maintenance	59	6.2	0.42	58	5.9	0.59	No	0.7073

B. BP HVAC EFFECTS

Although detailed finding results reveal some unexpected Wisconsin and Illinois comparison results, the Wisconsin distributor results support the existence of supply-side effects. Wisconsin distributors overwhelmingly agreed that energy-efficient equipment sales are important to maintaining their competitive position, as shown in Table 1-24, and that the program has played an important role in the market share of energy efficient units sold. Furthermore, Wisconsin distributors reported increased promotion of high efficiency units and increased sales in the past two years. In addition, we estimate that 70 percent of projects are out-of-program sales. In summary, results support the existence of market effects and therefore KEMA advises the PSC to pursue supplemental supply-side research.

Table 1-24. Importance of Energy-Efficient Equipment Sales in Maintaining Firm's Competitive Position, on Scale of 1 (= not at all important) to 10 (= very important)

Using a scale from 1 to 10 where 1 is not at all important and 10 is very important, how important is the offer of energy efficient equipment in maintaining your firm's competitive position?	State						2-tailed test of significance	
	Wisconsin			Illinois				
	n	estimate (avg)	standard error	n	estimate (avg)	standard error	Sig @ 90%	p-value
Score	25	9.1	0.2	26	7.5	0.5	Yes	0.0140

C. ROTARY EFFECTS

Because the VFD surveys engaged industrial end-users, no data were gathered from the supply-side of the VFD market. However, a number of questions were included in the surveys that probed for nonparticipant spillover effects in the rotary channel. Findings reveal limited nonparticipant spillover effects in the Rotary Channel. Wisconsin end-users take advantage of VFD opportunities at slightly higher rates than Illinois end-users, as shown in Table 1-25, and appear to be better informed about VFD technology than are their Illinois peers. However, despite the enthusiasm of participants, relatively few Wisconsin respondents have actually taken part in specific program measures. In summary, the *Channel Studies* provide enough evidence to pass the white paper's criteria in support for further research. We do recommend additional supply-side research for the VFD market, but less strongly than we do for Lighting and HVAC markets.

Table 1-25. VFD Opportunities Taken Advantage Of

Do you believe that you company has taken advantage of…	State				2-tailed test of significance	
	Wisconsin		Illinois			
	estimate	standard error	estimate	standard error	Sig @ 90%	p-value
All available opportunities to benefit from VFDs	21%	11.3%	9%	3.1%	No	0.3021
Most of those opportunities	14%	5.1%	15%	3.3%	No	0.9492
Some of those opportunities	10%	2.4%	9%	3.0%	No	0.8601
Few of those opportunities	7%	2.1%	6%	2.9%	No	0.8690
None of those opportunities	48%	11.2%	61%	3.2%	No	0.2671
# Respondents	176		122			

1.4 APPROACH

In order to establish contract metric baseline values, assess significant differences between Wisconsin and Illinois, and conduct preliminary research on supply-side effects, the evaluation team created detailed surveys targeting key market participants. Actors from each channel were surveyed in Wisconsin and Illinois using the computer-assisted telephone interview (CATI) approach, so that a total six surveys were conducted. Although two contract metrics were identified for VFDs, one pertaining to compressed air systems and the other to pump and fan systems, because both concern the rotary channel, a single survey encompassing both metrics was carried out in each state. All six surveys asked respondents about developments over the preceding twelve months, as opposed to the year 2007. This timeframe was selected in order to take advantage of the most recent and accurate market information available.

These six surveys were used to establish baseline values for the contract. KEMA used a ratio estimation approach to estimating market share indicators from contractor and vendor survey results. The basic rationale for this approach is that, for a variety of reasons, there exists large variation in the annual number of projects or unit sales by establishments in a given size stratum (as defined by number of employees). An estimate of market share based simply on the average of responses given (with appropriate stratum weights) would be highly inaccurate. The ratio estimation approach introduces the number of projects completed by the sample establishments directly into the computation of the market share indicator.

This approach permitted comparisons of efficiency improvements between Wisconsin and Illinois, and will permit temporal comparisons to be drawn in the future. The ultimate goal of these measurements is to determine whether the program is making progress along the route mapped out by the program logic.

The surveys were also used to assess indirect market effects generated by the program. Questions were posed to actors in all three channels in an attempt to determine the extent to which the program is having an untracked effect on the market. In conducting research into such indirect impacts, the appropriate first step is to probe the existence and character of any indirect effects occurring in the marketplace, as a prelude to further investigation. Therefore, this component of the evaluation was intended as an exploratory study of potential untracked market effects.

2. INTRODUCTION

The *Channel Studies—Fiscal Year 2008* report (*Channel Studies*) provides baseline estimates for the Focus on Energy Business Program market effect contract metrics and investigates other potential indicators of program market effects.

2.1 FOCUS ON ENERGY CONTRACT METRICS

The program administrator's contract metrics are contractual requirements for the program administrator. The contract metrics have included both operational metrics that can be tracked by the program and verified by evaluation, and market effects metrics. On the operational side, evaluation's primary role is to verify gross savings tracked by the program. Other operational metrics are reported by the program based on their own tracking and are not verified by evaluation. Market effects metrics relate to program effects that are not directly tracked by the program. The attainment of contract market effect metrics provides an indication that the program is on track with its program theory. It is not an indication that there is additional energy savings beyond what is tracked by the program.

In previous contract years, the evaluation team has determined achievement of market effect contract metrics through data collection and analysis. Historically the contract metrics have varied from year to year and covered a wide range of technologies, markets, and sectors. This approach is not conducive to the program reaching its potential effect on markets or evaluation's ability to meaningfully measure the program's effects. Market effects require concentrated and sustained program efforts. For the current 18-month contract period, the program administrator established a small number of narrowly defined long-term market effects metrics. The narrower focus and extended time period increases the potential the program's efforts will have an effect on the market and increases the likelihood that the effect will be measurable.

The program administrator is focusing on four specific technologies within its Channel Initiatives. The channels and selected technologies are shown in Table 2-1. The verbatim contract metrics as they appear in the program administrator's contract are provided in Appendix G.

Table 2-1. Contract Metric Channel Technologies

Channel	Technology
Lighting	High bay fluorescent lighting systems
BP HVAC	High efficiency rooftop units
Rotary	VFD controlled compressed air systems
	VFD controlled industrial pumps and fans

The primary purpose of the *Channel Studies* is the establishment of baseline estimates of these market effects contract metrics. The goal of this analysis is the design and implementation of quantitative processes that will allow the measurement of these contract metrics in Fiscal Year 2008 and again in three years to assess achievement over an extended period of time.

The transition to net savings goals from gross savings goals has increased the level of attention on net-to-gross adjustments. As in prior evaluations, we are motivated to provide a

complete assessment of program accomplishments. Evaluation savings adjustments for effects of the program that are not tracked by the program must be considered along with adjustments for measures that would have been implemented without the program. To this end, KEMA added a secondary goal of the *Channel Studies* that was not included in the detailed evaluation plan. This goal is to assess the qualitative evidence to date that there are sizable additional program effects on the market that are not already being captured by the program tracking and current evaluation activities. The purpose of this secondary effort is not to quantify potential program effects in terms of energy savings.

2.2 APPROACH

The scope of the *Channel Studies* was discussed in Section 2.5.1 of the *Business Programs: Contract FY08—Detailed Evaluation Plan* finalized on August 6, 2007.

The approach used in this evaluation was driven by the need to meet two basic objectives.

- Estimate baseline values of contract metrics.
- Identify and assess other potential indicators of program market effects.

Contract metrics are measures of market conditions that the evaluation team, implementers, and the PSC have all identified as appropriate indicators of potential program effects on target markets. There are four target markets: commercial and industrial lighting; energy-efficient commercial HVAC equipment; variable frequency drives (VFDs) used to control industrial compressed air systems; and VFDs used to control industrial pump and fan systems. Assessments of market effects are most useful when specific measurements taken at different points in time are compared to one another, in order to determine the extent to which the program is generating real and sustained market effects. Therefore, the present study focused on establishing baseline values for each contract metric, so that temporal comparisons will be possible in the future. It is anticipated that contract metrics will be measured again in a follow-up study to be conducted in approximately three years, which will allow for comparisons to be drawn with baseline values and overall program effectiveness to be evaluated more fully.

In addition to estimating contract metric baseline values for Wisconsin, the evaluation estimated such values for Illinois. State-to-state comparison of the change in the values for these contract metrics over time will serve as an indicator of net program effects. Illinois was chosen as the comparison state because it is comparable to Wisconsin in terms of size and composition of economic base. At the time this research was developed, Illinois lacked a comprehensive, statewide efficiency program akin to Focus on Energy's Business Programs.[4]

[4] Fortunately for business owners in the region, but unfortunately for this research effort, utilities and government agencies in all states in the upper Midwest have implemented C&I energy efficiency rebate programs targeting lighting, HVAC, and VFD applications, or are in the process of doing so. In Illinois, both Commonwealth Edison and Ameren have filed energy efficiency program plans that include these kinds of rebate programs, but these programs were not active during the Channel Studies baseline time period. Thus, studies focusing on Illinois customer and vendor behavior in the previous twelve months will not be affected by program activity in the comparison state. However, depending on when the follow-up study occurs, the presence of energy efficiency programs in the comparison state may affect the nature of the comparison region. Given the rapid advance of energy efficiency programs in many states, it is difficult to predict what states will

By estimating baseline values for both states, this research has enabled present differences to be highlighted, program effects to be elucidated and future changes in each state to be juxtaposed for comparative purposes.

While Illinois served as a useful and appropriate comparison state in the present research effort, it is unclear whether Illinois will be able to play a similar role three years from now. A number of nonresidential energy efficiency programs have launched in Illinois in the second half of 2008, and these are likely to have impacted the Illinois market to a measurable degree by the time the next *Channel Studies* evaluation is conducted. Such an impact will probably shift Illinois closer to Wisconsin in terms of energy efficiency market indicators, and will render interpretation of cross-state differences considerably more difficult. It may be appropriate to consider selecting another comparable state that lacks comprehensive nonresidential energy-efficiency programs, for example, Alabama, for future baseline comparisons. Alternatively, it may be appropriate to contemplate revisions to the contract metrics to compensate for changes in Illinois.

The *Channel Studies* also examined market effects not directly caused by the program, but indirectly attributable to it. This element of the research centered mainly on supply-side effects, or indirect impacts on vendor behavior generated by the program. Nonparticipant spillover effects were investigated to a lesser extent. Consideration of indirect impacts was driven by the current transition from gross to net energy savings goals and the resultant focus on net-to-gross (NTG) savings adjustments. The present study was intended to gather and assess preliminary data on indirect program effects, as a prelude to possible future elaboration of formal indicators.

KEMA estimated the contract metric baseline values and probed supply-side effects and other forms of spillover using the results of the surveys of key market actors in each channel under consideration. The rationale for the selection of each market actor is provided in Table 2-2.

Table 2-2. Market Actors Surveyed

Channel	Market Actor	Rationale for Selected Market Actor
Lighting	Lighting installation contractors	Contractors were selected because they are more knowledgeable than lighting distributors about where lamps are installed. In addition, contractors can provide better market-level data than can end-users.

constitute appropriate comparisons two to three years from now. Two key factors that argue for the use of Illinois as a comparison state are its size and the composition of its economic base. Illinois's populations of electrical contractors, HVAC distributors, and manufacturing companies in the key Wisconsin SICs are sufficiently large to support the proposed research plan. This will not be the case in many states.

Channel	Market Actor	Rationale for Selected Market Actor
BP HVAC	HVAC distributors	Distributors were chosen because they are particularly knowledgeable about rooftop unit (RTU) sales. In a typical year, HVAC contractors are not active enough to provide reliable market penetration estimates and for this reason were not selected as survey subjects.
Rotary	Industrial end users	Distributors are normally unaware of specific VFD applications. While vendors/contractors are more knowledgeable about VFD applications, they are a diverse group and difficult to identify. Only end-users are both knowledgeable about VFD applications and readily identifiable and were therefore selected for surveys.

The evaluation team recognized that additional groups of market actors play important roles in each channel under study and as such represent other potentially useful sources of information. However, surveying additional market segments would have introduced significant methodological difficulties into the research effort, for instance, the complexities involved in combining dissimilar data samples. The broad scope of this study (three channels and two states) was only practical with the computer-assisted telephone interview (CATI) approach and the relatively straightforward sample frame definitions. Expanding the scope of the surveys would have challenged practical resource constraints, including time and budgetary limits. While restricting analytical focus to the above actors necessarily excluded additional market activity and information, these actors are ideally positioned to offer key data on program effectiveness, and that focusing on them was the most efficient and effective way of achieving research goals.

Actors from each channel were surveyed in Wisconsin and Illinois using the CATI approach, so that a total six surveys were conducted. Although two contract metrics were identified for VFDs, one pertaining to compressed air systems and the other to pump and fan systems, because both concern the rotary channel, a single survey encompassing both metrics was carried out in each state. All six surveys asked respondents about developments over the preceding twelve months, as opposed to the year 2007. This timeframe was selected in order to take advantage of the most recent and accurate market information available.

These six surveys were used to establish baseline values for the four contract metrics. Measuring these values permitted comparisons of efficiency improvements between Wisconsin and Illinois, and will permit temporal comparisons to be drawn in the future. The ultimate goal of these measurements is to determine whether the program is making progress along the route mapped out by the program logic.

The surveys were also used to assess indirect market effects generated by the program. Questions were posed to actors in all three channels in an attempt to determine the extent to which the program is having an untracked effect on the market. In conducting research into such indirect impacts, the appropriate first step is to probe the existence and character of any indirect effects occurring in the marketplace, as a prelude to further investigation. Therefore,

this component of the evaluation was intended as an exploratory study of potential spillover effects.

When conducting a survey, the accuracy and precision of estimates of the true population values will depend on a combination of the population size, the sample size, and the homogeneity of the responses to the question. Stratification of a sample helps to gain precision, but its utility varies with the different patterns of answers to each question. Typically, in a survey of nonparticipants, we expect to interview between five percent and ten percent of the firms contacted. That means the population has to be between ten and twenty times the size of the final number of interviews, in order to complete as many as planned. When the populations are small, the incidence rate (firms who consent to be interviewed) limits the precision of our estimates.

In the results, this noticeably increases the confidence intervals around each estimate. The larger the confidence interval, the harder it is for a given difference between states to appear statistically significant. Substantive significance is a separate issue; it is possible for a difference to appear large, but not pass a significance test. In such cases, this report uses the best available information, and judgments base of the evaluation team's collective experiences. In some cases, experience suggests that the difference between two states is not meaningful, while in others the same magnitude of difference is argued to be important, although not with full confidence.

2.3 REPORT ORGANIZATION

The remainder of this report is organized as follows. Section 3 focuses on baseline values for contract metrics. The baseline values for all four metrics and the surveys conducted for each channel are discussed in detail. Beginning with the lighting channel metric, results are summarized, methodological approach detailed, data collection activities are described, and survey findings are considered in detail. Each of these items is then discussed with respect to the HVAC metric and the rotary metrics.

Section 4 examines potential indirect program impacts. It begins with a brief consideration of supply-side effects and their significance in the context of NTG adjustments. This is followed by a discussion of supply-side effects in the lighting channel, then by a discussion of such effects in the HVAC channel. The section concludes with an assessment of nonparticipant spillover effects in the VFD market.

The appendices include the complete texts of all six surveys conducted, as well as the verbatim contract metrics as they appear in the program administrator's contract.

3. METRIC BASELINES

This section provides contract metric baseline values for the Lighting, BP HVAC, and Rotary Channel market effects contract metrics. The baseline values, the detailed approach, data collection activities, and detailed findings are provided separately for each channel.

3.1 LIGHTING CHANNEL METRIC

3.1.1 Metric Results

A. PRIMARY METRICS

The program selected high-bay fluorescent lighting as the subject of the Lighting Channel market effect contract metric. The program has marketed and promoted high-bay fluorescent lighting for the past seven years and plans to continue these efforts. Program activities have included prescriptive incentives, training, and distribution of information. As shown in Table 3-1 the program contract defines the "critical metric" as follows, "Increase in net Wisconsin market share of high-bay fluorescent lighting systems across all market segments compared to any increase in net market share for Illinois baseline, and to standard HID technology." The evaluation developed indicators of this metric through a survey of electrical contractors who install commercial lighting. These contractors were selected as a target group because they are more knowledgeable than distributors about lamp installation sites, and a better source of market-level data than end-users.

Table 3-1. Lighting Contract Metric Baseline Approach

Channel	Critical Metric	Summary of Operational Definition
Lighting	Increase in net Wisconsin market share of high-bay fluorescent lighting systems, across all market segments, compared to any increase in net market share from Illinois baseline, and to standard HID technology.	% of projects installed high-bay lighting % of high-bay *recommended* fluorescent over HID % of high-bay *installed* fluorescent over HID

Table 3-2 shows the sequence of questions used to construct the high-bay lighting metric. The complete versions of the Wisconsin and Illinois Lighting Contractor Surveys are provided in Appendix A and B, respectively.

Table 3-2. Lighting Contract Metric Survey Sequence

Survey Question #	Survey Question Text
4.3	In what percent of the commercial and industrial lighting projects you completed in the past 12 months did you install high-bay lighting equipment of any type? [If necessary say, "High-bay lighting is defined as lighting installed greater than 20 feet off the floor. Common high-bay installations are warehouses, industrial facilities, and gymnasiums."]
4.4	In what percent of the projects in which you installed high-bay lighting did you recommend installation of fluorescent as opposed to HID fixtures?

Survey Question #	Survey Question Text
4.5	In what percent of the projects in which you installed high-bay lighting did you actually install fluorescent as opposed to HID fixtures?

These questions represent the operational definition of the Lighting Channel's critical metric. Tables 3-3 and 3-4 present the metrics baselines estimates for Wisconsin and Illinois, respectively. Table 3-3 shows that, on average, contractors in Wisconsin installed high-bay lighting equipment in 28 percent of the commercial and industrial lighting projects completed over the previous twelve months. Wisconsin lighting contractors recommended fluorescent as opposed to HID fixtures in an average 69 percent of these high-bay lighting projects, and actually installed fluorescent as opposed to HID fixtures in an average 72 percent of such projects.[5]

Table 3-3. Lighting Channel Metric Baselines: Wisconsin

Wisconsin					
				90% Confidence Interval	
Operational Definition	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of C&I lighting projects completed in past 12 months with high-bay lighting installation	60	28%	9.1%	12.9%	43.4%
Percent of high-bay lighting projects for which fluorescent as opposed to HID fixtures were recommended	59	69%	10.4%	52.0%	86.7%
Percent of high-bay lighting projects for which fluorescent as opposed to HID fixtures were installed	59	72%	9.0%	57.3%	87.3%

Table 3-4 indicates that Illinois contractors performed high-bay lighting installations in 25 percent of completed projects. Illinois firms recommended fluorescent fixtures in 51 percent of applicable projects. The rate of fluorescent fixture installation in Illinois was 28 percent.

Table 3-4. Lighting Channel Metric Baselines: Illinois

Illinois					
				90% Confidence Interval	
Operational Definition	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of C&I lighting projects completed in past 12 months with high-bay lighting installation	57	25%	4.5%	17.1%	32.0%
Percent of high-bay lighting projects for which fluorescent as opposed to HID fixtures were recommended	57	51%	11.5%	32.1%	70.7%
Percent of high-bay lighting projects for which fluorescent as opposed to HID fixtures were installed	57	28%	9.2%	12.4%	43.2%

Table 3-5 demonstrates that, while contract metric baseline values for high-bay lighting installation rates and fluorescent fixture recommendation rates were comparable in Wisconsin and Illinois, baseline values for fluorescent fixture installation rates differed significantly. The difference between high-bay lighting installation rates in the two states, measured at 28 percent in Wisconsin and 25 percent in Illinois, was not statistically significant. Neither was the difference between fluorescent recommendation levels, although Wisconsin lighting

[5] Installation rates may surpass recommendation rates in cases where customers instruct lighting contractors to install efficient equipment without having received a contractor recommendation.

contractors recommended efficient fluorescent fixtures at a rate 18-percentage-points higher than their Illinois counterparts. However, the difference between the states' fluorescent fixture installation rates, with Wisconsin contractors installing efficient fixtures at a 44-percentage-point higher level than Illinois contractors, was statistically significant at the one-percent level (p-value = 0.0005). A one-tailed test of significance was used for this metric because we expected to see a larger baseline value for Wisconsin compared to Illinois. This stands as strong evidence that fluorescent lighting systems account for a substantially larger share of the high-bay lighting market in Wisconsin than in Illinois. Given that the existence of the Business Programs is one of the major differences between these two markets, it is reasonable to infer that Focus on Energy is at least partially responsible for the higher market share of high-bay fluorescent fixtures in Wisconsin.

Table 3-5. Lighting Channel Metric Baseline Comparisons

Operational Definition	p-value	Significance Level			
		90%	95%	99%	2-tailed or 1-tailed test
Percent of C&I lighting projects completed in past 12 months with high-bay lighting installation	0.7257	No	No	No	2-tailed test
Percent of high-bay lighting projects for which fluorescent as opposed to HID fixtures were recommended	0.1259	No	No	No	1-tailed test
Percent of high-bay lighting projects for which fluorescent as opposed to HID fixtures were installed	0.0005	Yes	Yes	Yes	1-tailed test

Other factors may also help explain this significant difference. Higher levels of educational attainment, greater levels of environmental awareness, and/or stronger sustainable business norms may have contributed to a higher baseline value in Wisconsin. Nevertheless, the distinctive presence of Focus on Energy likely played an independent role in bringing about higher fluorescent fixture installation rates in Wisconsin relative to Illinois.

B. SUPPLEMENTARY METRICS

The evaluation also estimated the market share of other efficient lighting technologies for use in developing supplementary metrics of program effects. Because high-bay lighting is not universally present in commercial establishments, restricting the focus of the search for market effects to this niche would have been proven unduly limiting.

The evaluation team sought information on the portion of total C&I projects in which the following efficient lighting technologies were recommended and installed high performance T8 systems, T5 lighting technology, occupancy sensors, and automatic daylighting controls.

Table 3-6 shows the sequence of questions used to construct the supplemental Lighting Channel metrics.

Table 3-6. Supplemental Lighting Metric Survey Sequence

Survey Question #	Survey Question Text
4.1	In what percentage of the commercial and industrial lighting projects you completed in the last 12 months did you recommend or specify [High Performance T-8 Systems as defined by CEE; T-5 Lighting technology (IF NECESSARY SAY, "includes T5 and T5 High Output"); Occupancy controls; Automatic daylighting controls]? Your best estimate is fine.

Survey Question #	Survey Question Text
4.2	In what percentage of those projects did you actually install [High Performance T-8 Systems as defined by CEE; T-5 Lighting technology (IF NECESSARY SAY, "includes T5 and T5 High Output"); Occupancy controls; Automatic daylighting controls]?

Table 3-7 and Table 3-8 show the supplemental lighting metric baseline results for Wisconsin and Illinois, respectively. In Wisconsin, high performance T-8 systems were recommended in an average 60 percent of lighting projects completed over the previous year, and T-8 systems were installed an average 60 percent of recommended projects.[6] T-5 technology was recommended in an average 20 percent of projects and actually installed in an average 14 percent of recommended projects. Occupancy controls were recommended in an average 61 percent of Wisconsin projects, and installed in 69 percent of them. Automatic daylighting controls were recommended in an average 15 percent of Wisconsin lighting projects and installed in 19 percent of recommended projects.

Table 3-7. Supplemental Lighting Metric Baselines: Wisconsin

Wisconsin						
					90% Confidence Interval	
Supplemental Lighting Metrics	Technology	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of C&I lighting projects completed in past 12 months the contractor recommeded or specified…	High performance T-8 Systems as defined by CEE	60	60%	4.9%	51.6%	67.9%
	T-5 Lighting technology	58	20%	2.9%	14.8%	24.5%
	Occupancy controls	60	61%	6.8%	49.3%	72.0%
	Automatic daylighting controls	60	15%	5.1%	6.7%	23.8%
Percent of C&I lighting projects completed in past 12 months the contractor installed…	High performance T-8 Systems as defined by CEE	60	60%	5.6%	51.0%	69.7%
	T-5 Lighting technology	58	14%	5.2%	5.0%	22.6%
	Occupancy controls	60	69%	10.6%	51.5%	86.9%
	Automatic daylighting controls	59	19%	7.1%	7.5%	31.3%

In Illinois, contractors recommended T-8 systems in 58 percent of projects and installed them in 68 percent of recommended projects. T-5 technology was recommended in an average 32 percent of lighting projects, and installed in an average 41 percent of recommended projects. Illinois contractors recommended occupancy controls in 21 percent of lighting projects and daylighting controls in 16 percent of them, and installed these two technologies in 22 percent and 14 percent of recommended projects, respectively.

[6] For supplementary metrics, recommendation rates represent the percentage of total projects completed over the previous year for which high-efficiency technology was recommended, while installation rates refer to the percentage of *recommended* projects in which high-efficiency equipment was actually installed. Installation rates *do not* refer to the percentage of *total* projects in which high-efficiency equipment was installed. For this reason, installation rates may be higher than recommendation rates.

Table 3-8. Supplemental Lighting Metric Baselines: Illinois

Illinois						
					90% Confidence Interval	
Supplemental Lighting Metrics	Technology	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of C&I lighting projects completed in past 12 months the contractor recommeded or specified…	High performance T-8 Systems as defined by CEE	59	58%	7.8%	45%	71%
	T-5 Lighting technology	58	32%	12.3%	11%	52%
	Occupancy controls	57	21%	3.6%	15%	27%
	Automatic daylighting controls	57	16%	5.8%	6%	26%
Percent of C&I lighting projects completed in past 12 months the contractor installed…	High performance T-8 Systems as defined by CEE	58	68%	6.7%	57%	79%
	T-5 Lighting technology	56	41%	10.6%	24%	59%
	Occupancy controls	57	22%	6.1%	11%	32%
	Automatic daylighting controls	58	14%	6.4%	3%	25%

Table 3-9 presents supplemental lighting metric baseline comparisons of Wisconsin and Illinois. Significance levels were calculated with a one-tailed test of all Supplemental Lighting Metrics because we expected the results to be higher in Wisconsin compared to Illinois. Differences in recommendation rates between Wisconsin and Illinois for high-performance T-8 systems, T-5 technology, and automatic daylighting controls were not statistically significant. However, the difference in occupancy control recommendation rates between Wisconsin and Illinois, measured at 60 percent and 21 percent, respectively, was statistically significant at the one-percent level (p-value < 0.0001).

Similarly, the difference in occupancy control installation rates between the two states, measured at 69 percent in Wisconsin and 22 percent in Illinois, was statistically significant at the one-percent level (p = 0.0001). Differences in high-performance T-8 system installation levels and daylighting control installation levels were not significant. Illinois lighting contractors installed T-5 technology at a rate of 41 percent compared to 14 percent for Wisconsin contractors, a difference that was statistically significant at the five-percent level (p-value = 0.0118). The reason for this disparity in T-5 installation rates is unclear, but one possibility may be related to the fact that T-8 rebates are available in Wisconsin but not in Illinois. Without rebates, and given the generally higher margins associated with T-5 technology, Illinois contractors may encounter stronger incentives to sell T-5 equipment than their Wisconsin counterparts, resulting in higher installation rates.

Wisconsin contractors recommended occupancy controls at a level 40-percentage-points higher than Illinois contractors, and Wisconsin contractors installed this technology at a level 47-percentage-points higher. Recommendation and installation rates for T-8 systems and daylighting controls were similar for both states. Recommendation rates for T-5 technology were also similar, but Illinois contractors installed T-5 technology at a 27-percentage-point greater level. This finding runs counter to program logic and represents an anomaly.

Table 3-9. Supplemental Lighting Metric Baselines Comparisons

			Significance Level			
Supplemental Lighting Metrics	Technology	p-value	90%	95%	99%	2-tailed or 1-tailed test
Percent of C&I lighting projects completed in past 12 months the contractor recommeded or specified…	High performance T-8 Systems as defined by CEE	0.4178	No	No	No	1-tailed test
	T-5 Lighting technology	0.1717	No	No	No	1-tailed test
	Occupancy controls	0.000002	Yes	Yes	Yes	1-tailed test
	Automatic daylighting controls	0.4644	No	No	No	1-tailed test
Percent of C&I lighting projects completed in past 12 months the contractor installed…	High performance T-8 Systems as defined by CEE	0.1892	No	No	No	1-tailed test
	T-5 Lighting technology	0.0118	Yes	Yes	No	1-tailed test
	Occupancy controls	0.0001	Yes	Yes	Yes	1-tailed test
	Automatic daylighting controls	0.2801	No	No	No	1-tailed test

3.1.2 Detailed Approach

As in similar studies previously carried out by KEMA, the evaluation team used a ratio estimation approach to estimating market share indicators from contractor and vendor survey

results. The basic rationale for this approach is that, for a variety of reasons, there exists large variation in the annual number of projects or unit sales by establishments in a given size stratum (as defined by number of employees). An estimate of market share based simply on the average of responses given (with appropriate stratum weights) would be highly inaccurate. The ratio estimation approach introduces the number of projects completed by the sample establishments directly into the computation of the market share indicator.

Contractor survey responses were weighted to reflect the number of projects in commercial and industrial facilities completed by the sample contractor as well as the population weight of the size stratum from which the firm was drawn. Where the questionnaire sought responses in the form of a number or percentage—for example, the portion of projects completed in which high-bay fluorescent lamps were installed—survey responses were calculated using the combined ratio estimator $\hat{R}_c$:

$$\hat{R}_c = \frac{\sum_h \frac{N_h}{n_h} \sum_i B_{h_i} x_i}{\sum_h \frac{N_h}{n_h} \sum_i x_i},$$

where

i = sample contractor,

N_h = number of contractors in the population in sample stratum h,

n_h = number of contractors in the sample in stratum h,

B_{h_i} = contractor i's response (expressed as a percentage), and

x_i = number of relevant projects contractor i completed in the evaluation period.

If the question elicited a categorical response (e.g., yes/no), a B_{h_i} was created for each possible response. For the selected response (responses if choose all that apply), B_{h_i} = 1. For the response/s not selected, B_{h_i} = 0.

The use of the combined ratio estimator supports the estimate of a standard deviation and standard error for each variable. The standard errors were used to calculate confidence intervals and in the difference of means tests.

3.1.3 Data Collection

The evaluation team applied a stratified random sampling approach to selecting the sample of Wisconsin and Illinois lighting contractors to be interviewed. Details of this approach are as follows:

- **Sample frame.** The team used the iMarket Database of Dun & Bradstreet data as the sample frame. This database contains a great deal of information on individual building establishments, including name, location, primary and secondary business activities, number of employees, and annual revenues. Information on business activity and number of employees is fairly accurate for establishments with at least 10 employees. Moreover, aggregated D&B data for establishments with 10 or more employees matches up fairly well with data from other sources, such as the Economic Census and the Bureau of Labor Statistics. For smaller establishments, which tend to be less stable, coverage and accuracy is less consistent. The study screened all respondents to ensure that they were included in the appropriate stratum and adjusted stratum weights to reflect reallocations of respondents.
- **Target population.** The target population was all establishments listed as having commercial lighting installation contracting as their primary SIC (1731-9903, 1731-9904). These two 8-digit categories (General Electrical Contractors and Lighting Contractors) account for roughly 60 percent of all establishments listed in the 1731: Electrical Work category.
- **Sample stratification and allocation.** The evaluation team used number of employees as the stratification variable. The study allocated the total sample to size strata in proportion to the percentage of total SIC employment represented by the individual stratum. In cases where there were not sufficient numbers of establishments to accommodate this approach, cases were allocated to the next lowest size category in terms of percentage of total SIC employment.
- **Sample size.** The proposal called for a sample size of 120 combined for the Wisconsin and Illinois samples, or 60 per state. Given the approach to market share estimation outlined above, n = 60 is the maximum useful size for the Wisconsin sample. Adding observations in the smaller size strata would have done little to increase the precision of the estimate.

Table 3-10 shows the proposed and final allocations of lighting contractor samples. The target of 60 completes was achieved in both Wisconsin and Illinois. Within the upper employment categories, the number of completes fell short of the number that was targeted, while within the lower employment strata, the number of actual completes surpassed the original targets. This was due to the relatively small number of establishments in the higher employment strata, which were exhausted and necessitated shifting to lower strata in order to meet overall quotas.[7]

Table 3-10. Lighting Contractor Sample Disposition

State	Employment Category	% of Total SIC Employment	# of Establishments	Target Completes	# of Completes	Strata Disposition
WI	1-4	10%	335	6	17	Achieved
	5-24	28%	192	17	29	Achieved
	25-100	32%	50	27	10	Exhausted
	100+	31%	12	10	4	Exhausted
	Total	**100%**	**589**	**60**	**60**	**Achieved**

[7] Information on response rates from the survey house is a planned addition to the final draft.

State	Employment Category	% of Total SIC Employment	# of Establishments	Target Completes	# of Completes	Strata Disposition
IL	1-4	8%	521	5	15	Achieved
	5-24	28%	368	16	32	Achieved
	25-100	38%	116	21	12	Exhausted
	100+	26%	21	17	1	Exhausted
	Total	**100%**	**1,026**	**60**	**60**	**Achieved**

Data were collected using CATI surveys of lighting installation contractors conducted by Braun Research. Surveys were conducted in both Wisconsin and Illinois from May 19 through June 25, 2008. The contractor interviews addressed a number of topics, including technology specification, equipment installation, and program effects. Key information gathered by the surveys included:

- Percentage of projects in past 12 months in which high-bay lighting was installed
- Percentage of projects in which fluorescent lighting was recommended
- Percentage of projects in which fluorescent lighting was installed
- Percentage of projects in which other efficient lighting technologies were recommended and installed
- Influence of Focus on Energy on promotion of energy-efficient lighting equipment (for Wisconsin respondents)

3.1.4 Detailed Findings

In Section 3.1.1, KEMA reported that the market share of high-bay fluorescent lighting systems and occupancy controls are higher in Wisconsin relative to Illinois. It is reasonable to infer that Focus on Energy contributed to the higher market shares in Wisconsin. In this section, we take a closer look at the results and explore the differences between the Wisconsin and Illinois markets for efficient lighting technologies. We begin with an examination of promotional efforts of contractors, and then consider a wider range of market trends.

A. PROMOTION OF ENERGY EFFICIENT LIGHTING

After data were collected on metric baselines, the evaluation team explored supply-side phenomena with a series of questions concerning promotional activities and business strategy. Table 3-11 shows results from a question about the promotion of energy-efficient lighting technology for Wisconsin and Illinois. Wisconsin contractors representing 47 percent of projects completed responded that their promotion of energy-efficient lighting had increased over the previous two years. Contractors representing 53 percent of projects completed reported that their promotional levels had not changed. No Wisconsin lighting contractors reduced their promotional efforts. In Illinois, contractors representing 67 percent of projects had increased their promotion of energy-efficient lighting technology. The remaining 32 percent of Illinois respondents had maintained their efforts at a stable level.

Table 3-11. Trends in Promotion of Energy-Efficient Lighting Over Past Two Years

Over the past 2 years, would you say that your firm's efforts to promote energy-efficient lighting products to commercial and industrial customers have…	State				2-tailed test of significance	
	Wisconsin		Illinois			
	estimate (avg)	standard error	estimate (avg)	standard error	Sig @ 90%	p-value
Increased	47%	15.4%	67%	10.8%	No	0.2996
Decreased	0%	na	0%	na	na	na
Stayed about the same	53%	15.4%	32%	10.7%	No	0.2827
# Respondents	60		60			

Despite the 20-percentage-point higher level of increased promotional effort in Illinois relative to Wisconsin, when examined closely this difference was found not to be statistically significant. Although promotion rates in these two states were comparable, higher rates in Illinois would not necessarily have been surprising. It is likely that most contractors in Wisconsin have been working with Focus on Energy for more than two years. If this is the case, then these contractors probably would have intensified their promotion of energy-efficient lighting several years ago, well before more recent advances in neighboring Illinois. Stable promotional levels in Wisconsin may well be higher than growing levels in Illinois.

Lighting contractors were also asked what the most important reason was to promote energy-efficient lighting. The most common answer among Wisconsin firms was “customer satisfaction/retention,” selected by contractors representing 37 percent of projects. The most common answer for Illinois firms was “increased revenue or margin,” chosen by firms representing 26 percent of projects. Illinois contractors representing only 20 percent of projects selected customer satisfaction, while Wisconsin contractors representing only five percent of projects selected increased revenue. Firms in both states also mentioned energy savings, cost savings, and environmental concerns as reasons to promote energy-efficient lighting technology.

In addition, contractors were asked a more general question about the importance of energy-efficient equipment sales to their businesses. Specifically, on a scale of 1 to 10, where 1 is not at all important and 10 is very important, firms were asked to rate the significance of such sales in maintaining their competitive position. Wisconsin firms assigned these sales an 8.2, while Illinois firms rated those 8.6. These results mirror those for promotional effort above, indicating that Wisconsin and Illinois firms take comparable account of energy-efficient equipment sales in their business strategies. As with promotional activities, the priority placed on high-efficiency sales by Wisconsin contractors likely predates the more recent importance attached to such sales by Illinois lighting contractors.

B. OTHER MARKET DEVELOPMENTS

The surveys also contained a number of supplementary questions on broader market issues including customer failure to follow recommendations, the perceived impact of Focus on Energy, the rate of cross-state contractor activity, and influences on customer purchasing decisions.

In response to a question about the reasons customers do not follow recommendations concerning efficient lighting; Illinois lighting contractors representing 77 percent of projects attributed customer refusals to the view that “cost is too high.” In Wisconsin, where recommendations are accepted much more often, firms representing only 32 percent of projects cited customer cost concerns. Wisconsin firms pointed to a variety of other reasons that customers do not follow efficiency recommendations, such as unsuitability to the project

and lack of consumer education. These findings suggest that cost is the major barrier to greater market penetration of efficient lighting equipment in Illinois, but is not a major barrier in Wisconsin. The fact that cost is a minimal factor in Wisconsin is likely attributable to the program, due either to program rebates, greater awareness of the cost savings associated with efficiency caused by exposure to the program, or some combination of the two.

Although this report has presented evidence indicative of both direct and indirect program effects, Wisconsin lighting contractors tended to discount the influence of Focus on Energy on the state's lighting market. Overall, contractors representing 97 percent of projects were aware of the Business Programs, and contractors responsible for 95 percent of projects had participated in projects that received program incentives. Yet on a scale of 1 to 10, where 1 is not at all important and 10 is very important, Wisconsin contractors assigned Focus on Energy a score of only 5.7 on the question of program influence on decisions to increase promotion of energy-efficient equipment. On a similar scale, these contractors assigned the program a score of 6.3 on the question of program influence on the market share of efficient lighting technologies.[8] Furthermore, Wisconsin firms responsible for 68 percent of projects said that the share of projects in which they installed high-bay fluorescent fixtures would have "stayed about the same" in the absence of Focus on Energy.

In addition, Wisconsin contractors representing 46 percent of projects had performed commercial and industrial lighting work in Illinois over the previous 12 months, installing an average 5.6 projects in the neighboring state. By contrast, Illinois contractors representing only 3 percent of projects had performed such work in Wisconsin, installing an average 5.2 projects. One possible explanation for this difference is that Wisconsin's lighting market and incentive program have not developed a reputation as offering especially attractive opportunities for out-of-state contractors. Another possibility is that the Chicago metropolitan area is particularly lucrative for Wisconsin contractors, but Wisconsin has no market of comparable size and proximity to draw in large numbers of Illinois lighting firms.

What explains this apparent disconnect between, on the one hand, strong evidence of program effectiveness in expanding the market share of fluorescent systems in Wisconsin, and on the other hand, a reticence on the part of lighting contractors to ascribe too much credit to the program?

One possibility may be that the Business Programs have helped to transform the market to such an extent that their importance has become obscured. Results indicate that Wisconsin consumers take greater account of multiple lighting equipment characteristics when selecting technology to purchase than do Illinois consumers. Respondents were asked to rate the importance customers attach to various lighting equipment characteristics when making purchasing decisions, on a scale of 1 to 10 where 1 is not at all important and 10 is very important. Results are presented in Table 3-11. Wisconsin contractors rated operating costs (7.8), quality of light (7.8), upfront costs (7.7), and total life cycle costs (7.1) as the most important characteristics, followed by ease of maintenance (6.2) and maintenance of lighting level (6.0). Ratings by Illinois contractors were lower, with initial cost (7.3) and quality of light (6.6) ranked highest. Operating costs (6.1), total life cycle costs (6.0), maintenance of lighting level (5.9), and ease of maintenance (5.9) were regarded as less important to customer selection decisions by Illinois firms.

[8] By comparison, nearly identical questions posed to HVAC distributors elicited scores of 7.2 and 8.0, respectively.

Table 3-12. Importance of Lighting Equipment Characteristics to Customer Selection Decisions, on Scale of 1 (= not at all important) to 10 (= very important)

On a scale from 1 to 10 where 1 is not at all important and 10 is very important, how important do your commercial customers treat the following lighting equipment characteristics when making equipment selection decisions?	State						2-tailed test of significance	
	Wisconsin			Illinois				
	n	estimate (avg)	standard error	n	estimate (avg)	standard error	Sig @ 90%	p-value
Initial cost of ther equipment	59	7.7	0.20	58	7.3	0.52	No	0.3974
Costs of operation	59	7.8	0.27	58	6.1	0.56	Yes	0.0102
Total life cycle costs	59	7.1	0.20	58	6.0	0.59	Yes	0.0979
Quality of light	59	7.8	0.27	58	6.6	0.65	Yes	0.0959
Maintenance of lighting level	59	6.0	0.66	58	5.9	0.70	No	0.9013
Ease of maintenance	59	6.2	0.42	58	5.9	0.59	No	0.7073

Three of these characteristics were ranked higher by Wisconsin contractors than by Illinois contractors at the statistically significant ten-percent level: costs of operation (p-value = 0.0102), total life cycle costs (p-value = 0.0979), and quality of light (p-value = 0.0959). These findings suggest that Wisconsin consumers tend to be better informed about lighting equipment than are their Illinois counterparts, exhibiting greater appreciation for various economic and technological features of lighting systems. This in turn suggests that Focus on Energy, a major difference between these two states, has succeeded in altering customer attitudes toward lighting technology in such a way that cost savings and other advantages associated with efficient lighting technology have become self-evident to many consumers. If energy-efficient lighting equipment such as fluorescent high-bay fixtures were widely regarded as superior on multiple counts, then the program originally responsible for this change in preferences would likely be treated as an increasingly marginal cause over time.

It is also possible that other cross-state differences help explain varying customer views on lighting equipment characteristics. For example, differences in education levels may account for contrasting perspectives on lighting technology held by consumers in Wisconsin and Illinois. Alternatively, differences in levels of environmental awareness may contribute to differing perspectives on lighting equipment. However, it is likely that Focus on Energy has played a substantial role in influencing customer attitudes and purchasing decisions.

3.2 BP HVAC METRIC

3.2.1 Metric Results

A. PRIMARY METRICS

The program selected high efficiency rooftop units as the subject of the BP HVAC Channel market effect contract metric. The program has promoted this technology for many years through prescriptive incentives, training, and the distribution of information. The program decided to intensify its promotion of this technology in FY08 with two important changes. The program tripled the incentive and transferred the focus of its marketing efforts to promote the technology from the end-use customers to the trade allies. As shown in Table 3-13, the program contract defines the “critical metric” as follows, “Increase in net Wisconsin market share of high efficiency rooftop units in commercial, school, and government buildings, in comparison to increase in net market share from [the] Illinois baseline.”

Table 3-13. HVAC Contract Metric Baseline Approach

Channel	Critical Metric	Summary of Operational Definition
BP HVAC	Increase in net Wisconsin market share of high efficiency rooftop units in commercial, school and government buildings, in comparison to increase in net market share from Illinois baseline.	% of packaged commercial rooftop HVAC units sold that meet program efficiency standards

In order to develop operational estimates of the contract metric, the evaluation team used distributor self-reports of the volume of unit sales in unit size categories and the percentage of those units that meet program efficiency standards. Distributors were selected because they are particularly knowledgeable about efficient rooftop unit sales, as well as the fact that contractors typically are not active enough over the course of a year to provide good estimates of market penetration. The program's minimum efficiency standards changed as of March 1, 2008. This research used the new efficiency standards, which are as follows:

- <65 MBh: ≥ 11.6 EER
- 65 – 134 MBh: ≥ 11.5 EER
- 135 – 239 MBh: ≥ 11.5 EER
- 240 – 759 MBh: ≥ 10.5 EER

Table 3-13 shows the sequence of questions used to construct the packaged commercial rooftop HVAC unit metric. The complete versions of the Wisconsin and Illinois HVAC Distributor Surveys are provided in Appendix C and D, respectively.

Table 3-14. HVAC Contract Metric Survey Sequence

Survey Question #	Survey Question Text
3.1	First, over the past 12 months, how many packaged commercial rooftop HVAC units did you sell in [SIZE CATEGORY a – d]? [Size Categories: a. <65 MBh or <5.4 tons b. 65 – 134 MBh or 5.4 – 11.25 tons c. 135 – 239 MBh or 11.25 – 20 tons d. 240 – 749 MBh or 20 – 62.4 tons]

Survey Question #	Survey Question Text
3.2	[FOR EACH SIZE CATEGORY ASK:] What percent of these units had an efficiency rating of [EFFICIENCY RATING] or higher? [Efficiency Ratings by Size Category: a. 11.6 EER b. 11.5 EER c. 11.5 EER d. 10.5 EER]

These questions represent the operational definition of the BP HVAC Channel's critical metric. Together, they were used to estimate baseline values for both Wisconsin and Illinois. Tables 3-15 and 3-16 present the metric baseline estimates for Wisconsin and Illinois, respectively. In Wisconsin, for rooftop units smaller than 65 MBh/5.4 tons, 62 percent of units sold met program efficiency standards. For units between 65 MBh/5.4 tons and 134 MBh/11.25 tons, 41 percent of sales met program efficiency standards. For units between 135 MBh/11.25 tons and 239 MBh/20 tons, 36 percent of units sold met program efficiency standards, and for units between 240 MBh/20 tons and 749 MBh/62.4 tons, 29 percent of sales met program efficiency standards.

Table 3-15. BP HVAC Channel Metric Baselines: Wisconsin

Wisconsin						
					90% Confidence Interval	
Operational Definition	Size Category/ Efficiency Rating	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of sold units that meet program efficiency standards.	<65 MBh or <5.4 tons (11.6 EER or higher)	24	62%	9.2%	46.2%	77.7%
	65 - 134 MBh or 5.4 - 11.25 tons (11.5 EER or higher)	22	41%	9.1%	25.3%	56.7%
	135 - 239 MBh or 11.25 - 20 tons (11.5 EER or higher)	19	36%	4.5%	27.9%	43.3%
	240 - 749 MBh or 20 - 62.4 tons (10.5 EER or higher)	11	29%	7.4%	16.0%	42.6%

In Illinois, for rooftop units smaller than 65 MBh/5.4 tons, 38 percent of units sold met program efficiency standards. For units between 65 MBh/5.4 tons and 134 MBh/11.25 tons, 27 percent of sales met program efficiency standards. Likewise, 27 percent of units sold between 135 MBh/11.25 tons and 239 MBh/20 tons met program efficiency standards, and 32 percent of units sold between 240 MBh/20 tons and 749 MBh/62.4 tons met program efficiency standards.

Table 3-16. BPHVAC Channel Metric Baselines: Illinois

Illinois						
					90% Confidence Interval	
Operational Definition	Size Category/ Efficiency Rating	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of sold units that meet program efficiency standards.	<65 MBh or <5.4 tons (11.6 EER or higher)	25	38%	10.0%	20.9%	55.2%
	65 - 134 MBh or 5.4 - 11.25 tons (11.5 EER or higher)	23	27%	8.4%	13.0%	41.6%
	135 - 239 MBh or 11.25 - 20 tons (11.5 EER or higher)	19	27%	8.5%	12.5%	42.0%
	240 - 749 MBh or 20 - 62.4 tons (10.5 EER or higher)	9	32%	12.1%	10.1%	54.3%

Table 3-17 provides the results of a statistical comparison between the Wisconsin and Illinois baseline values. Significance levels were calculated with a one-tailed test of because we expected a larger fraction of the units sold in Wisconsin to meet program efficiency standards compared to Illinois. As Table 3-17 shows, although the baseline values reported above were higher than Illinois for three of the four size categories only one was significant at the ten

percent level. The share of high-efficiency sales for the smallest size category, units less than 65 MBh/5.4 tons, was statistically larger in Wisconsin compared to Illinois, at the five percent level (p-value = 0.0463). Models in this size category meet an Energy Efficiency Rating (EER) of 11.6 or greater sold at a 24-percentage-point higher rate in Wisconsin compared to Illinois.

Table 3-17. BP HVAC Channel Metric Baseline Comparisons

Operational Definition	Size Category/ Efficiency Rating	p-value	Significance Level			
			90%	95%	99%	2-tailed or 1-tailed test
Percent of sold units that meet program efficiency standards.	<65 MBh or <5.4 tons (11.6 EER or higher)	0.0463	Yes	Yes	No	1-tailed test
	65 - 134 MBh or 5.4 - 11.25 tons (11.5 EER or higher)	0.1400	No	No	No	1-tailed test
	135 - 239 MBh or 11.25 - 20 tons (11.5 EER or higher)	0.1977	No	No	No	1-tailed test
	240 - 749 MBh or 20 - 62.4 tons (10.5 EER or higher)	0.4214	No	No	No	1-tailed test

B. SUPPLEMENTARY METRICS

The evaluation also estimated the market share of other efficient HVAC technologies for use in developing supplementary metrics of program effects. Specifically, the evaluation team sought information on the portion of rooftop units sold fitted with dual enthalpy economizers and with demand control ventilation with CO_2 sensors.

Table 3-18 shows the sequence of questions used to construct the supplemental BP HVAC Channel metrics.

Table 3-18. Supplemental HVAC Metric Survey Sequence

Survey Question #	Survey Question Text
3.5	What percent of units that you sold during the past 12 months were fitted with dual enthalpy economizers?
3.6	What percent of units that you sold during the past 12 months were fitted with CO2 sensors and demand control ventilation systems?

Table 3-19 and Table 3-20 show the supplemental BP HVAC metric baseline results for Wisconsin and Illinois, respectively. In Wisconsin, 55 percent of rooftop HVAC units sold in the past 12 months were fitted with dual enthalpy economizers. Likewise, 54 percent of units sold in Wisconsin were fitted with CO_2 sensors and demand control ventilation systems.

Table 3-19. Supplemental BP HVAC Metric Baselines: Wisconsin

Wisconsin					
				90% Confidence Interval	
Supplemental HVAC Metrics	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of units sold in past 12 months fitted with dual enthalpy economizers.	23	55%	13.4%	32.3%	78.2%
Percent of units sold in past 12 months fitted with CO2 sensors and demand control ventilation systems.	20	54%	12.4%	32.7%	75.5%

In Illinois, 41 percent of units sold were equipped with dual enthalpy economizers. Only 27 percent of HVAC units sold in Illinois were fitted with CO_2 sensors and demand control ventilation systems.

Table 3-20. Supplemental BP HVAC Metric Baselines: Illinois

Illinois					
				90% Confidence Interval	
Supplemental HVAC Metrics	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of units sold in past 12 months fitted with dual enthalpy economizers.	25	41%	11.2%	21.9%	60.2%
Percent of units sold in past 12 months fitted with CO2 sensors and demand control ventilation systems.	25	27%	6.9%	14.9%	38.6%

Table 3-21 compares these supplemental HVAC metric baselines. Although a higher percentage of units sold in Wisconsin were fitted with dual enthalpy economizers, the difference was not statistically significant. However, the 27-percentage-point higher proportion of CO_2 sensor/demand control ventilation system sales in Wisconsin relative to Illinois was significant at the five percent level (p-value = 0.0343). A one-tailed test of significance was used for these metrics because we expected to see larger proportions in Wisconsin compared to Illinois.

Table 3-21. Supplemental BP HVAC Metric Baselines Comparisons

		Significance Level			
Supplemental HVAC Metrics	p-value	90%	95%	99%	2-tailed or 1-tailed test
Percent of units sold in past 12 months fitted with dual enthalpy economizers.	0.2126	No	No	No	1-tailed test
Percent of units sold in past 12 months fitted with CO2 sensors and demand control ventilation systems.	0.0343	Yes	Yes	No	1-tailed test

3.2.2 Detailed Approach

KEMA used a ratio estimation approach to estimating market share indicators from distributor survey results. The basic rationale for this approach is that, for a variety of reasons, there exists large variation in the annual number of projects or unit sales by establishments in a given size stratum (as defined by number of employees). An estimate of market share based simply on the average of responses given (with appropriate stratum weights) would be highly inaccurate. The ratio estimation approach introduces the number of units sold by the sample establishments directly into the computation of the market share indicator.

Distributor survey responses were weighted to reflect the number of units sold to commercial and industrial facilities by the sample distributor as well as the population weight of the size stratum from which the firm was drawn. Where the questionnaire sought responses in the form of a number or percentage—for example, the portion of rooftop units sold that met efficiency standards—survey responses were calculated using the combined ratio estimator $\hat{R}_c$:

$$\hat{R}_c = \frac{\sum_h \frac{N_h}{n_h} \sum_i B_{h_i} x_i}{\sum_h \frac{N_h}{n_h} \sum_i x_i},$$

where

i = sample distributor,

N_h = number of distributors in the population in sample stratum *h,*

n_h = number of distributors in the sample in stratum *h,*

B_{h_i} = distributor *i*'s response (expressed as a percentage), and

x_i = number of units distributor *i* sold in the evaluation period.

If the question elicited a categorical response (e.g., yes/no), a B_{h_i} was created for each possible response. For the selected response (responses if choose all that apply), B_{h_i} = 1. For the response/s not selected, B_{h_i} = 0.

The use of the combined ratio estimator supports the estimate of a standard deviation and standard error for each variable. The standard errors were used to calculate appropriate measures of precision for various kinds of results.

3.2.3 Data Collection

The evaluation team applied a stratified random sampling approach to selecting the sample of Wisconsin and Illinois HVAC distributors to be interviewed. Details of this approach are as follows:

- **Sample frame.** The team used the iMarket Database of Dun & Bradstreet data as the sample frame. This database contains a great deal of information on individual building establishments, including name, location, primary and secondary business activities, number of employees, and annual revenues. Information on business activity and number of employees is fairly accurate for establishments with at least 10 employees. Moreover, aggregated D&B data for establishments with 10 or more employees matches up fairly well with data from other sources, such as the Economic Census and the Bureau of Labor Statistics. For smaller establishments, which tend to be less stable, coverage and accuracy is less consistent. The study screened all respondents to ensure that they were included in the appropriate stratum and adjusted stratum weights to reflect reallocations of respondents.
- **Target population.** The target population was all establishments listed as having wholesale HVAC equipment supply as their primary SIC (5705).
- **Sample stratification and allocation.** The evaluation team used number of employees as the stratification variable. The study allocated the total sample to size strata in proportion to the percentage of total SIC employment represented by the individual stratum. In cases where there were not sufficient numbers of establishments to accommodate this approach, cases were allocated to the next lowest size category.
- **Sample size.** The proposal called for a sample size of 60 combined for the Wisconsin and Illinois samples, or 30 per state. Given the approach to market share estimation outlined above, n = 30 is the maximum useful size for the Wisconsin

sample. Adding observations in the smaller size strata would have done little to increase the precision of the estimate.

Table 3-22 shows the proposed and final allocations of HVAC distributor samples. The target of 30 completes was achieved in both Wisconsin and Illinois. Within the upper employment categories, the number of completes fell short of the number that was targeted, while within the lower employment strata, the number of actual completes surpassed the original targets. This was due to the relatively small number of establishments in the higher employment strata, which were exhausted and necessitated shifting to lower strata in order to meet overall quotas.[9]

Table 3-22. HVAC Distributor Sample Disposition

State	Employment Category	% of Total SIC Employment	# of Establishments	Target Completes	# of Completes	Strata Disposition
WI	1-9	29%	97	10	20	Achieved
	10-50	42%	25	14	9	Exhausted
	50-249	30%	5	6	1	Exhausted
	Total	**100%**	**127**	**30**	**30**	**Achieved**
IL	1-9	34%	229	9	13	Achieved
	10-50	42%	53	15	16	Achieved
	50-249	24%	6	6	2	Exhausted
	Total	**100%**	**288**	**30**	**30**	**Achieved**

Data were collected using CATI surveys of HVAC distributors conducted by Braun Research. Surveys were conducted in both Wisconsin and Illinois from May 19 through June 25, 2008. The distributor interviews addressed a number of topics, including equipment sales, market conditions, and program effects. Key information gathered by the surveys included:

- Percentage of rooftop units sold in past 12 months that met efficiency criteria
- Percentage of units sold equipped with other efficient technologies
- Extent of energy-efficiency promotion by HVAC distributors
- Percentage change in sales of high-efficiency HVAC equipment since 2005
- Influence of Focus on Energy on sales and promotion of high-efficiency HVAC equipment (for Wisconsin respondents).

3.2.4 Detailed Findings

In Section 3.2.1, KEMA reported that the market share of energy-efficient HVAC units smaller than 65 MBh/5.4 tons, as well as CO_2 sensors and demand control ventilation systems, are higher in Wisconsin relative to Illinois. It is reasonable to infer that Focus on Energy contributed to the higher market shares in Wisconsin. In this section, we take a closer look at the results and explore the differences between the Wisconsin and Illinois markets for efficient HVAC technologies. A wide range of market issues are explored, including business

[9] Information on response rates from the survey house is a planned addition to the final draft.

strategy, promotional activities, stocking practices, equipment availability, program influence, and cost differences.

A. BUSINESS STRATEGY

Firms were asked to rate the importance of energy-efficient equipment sales to maintaining their competitive position, using a 10-point scale where 1 is not at all important and 10 is very important. As Table 3-23 shows, Wisconsin distributors assigned energy efficiency a score of 9.1, while Illinois distributors rated it 7.5. This difference is statistically significant at the five percent level (p-value = 0.0140). This suggests that Wisconsin firms have privileged energy efficiency in their business calculations to a greater extent than their Illinois counterparts, which in turn suggests that the program has indirectly influenced distributors by intensifying consumer demand for high-efficiency HVAC equipment.

Table 3-23. Importance of Energy-Efficient Equipment Sales in Maintaining Firm's Competitive Position, on Scale of 1 (= not at all important) to 10 (= very important)

Using a scale from 1 to 10 where 1 is not at all important and 10 is very important, how important is the offer of energy efficient equipment in maintaining your firm's competitive position?	State						2-tailed test of significance	
	Wisconsin			Illinois				
	n	estimate (avg)	standard error	n	estimate (avg)	standard error	Sig @ 90%	p-value
Score	25	9.1	0.2	26	7.5	0.5	Yes	0.0140

B. PROMOTIONAL ACTIVITIES AND STOCKING PRACTICES

Firms in both states exhibited comparable levels of high-efficiency equipment promotion. Specifically, Wisconsin distributors representing 96 percent of units sold said that they had promoted energy-efficient packaged HVAC units to contractors in the past two years. In Illinois, distributors representing 98 percent of sales did so. Similarly, Wisconsin firms responsible for 92 percent of sales reported that they have increased such promotional efforts, and Illinois firms responsible for 94 percent of units sold increased their efforts. These results are surprising to the extent that program logic foresees more intensive promotional efforts in Wisconsin compared to states without programs similar to Focus on Energy. However, since it is likely that many Wisconsin distributors have been working with Focus on Energy for more than two years, it is probable that promotion levels in Wisconsin have been high for some time. By contrast, there is no evidence to suggest that promotion levels in Illinois were as high two years ago as they are now.

Although promotion rates in these two states were comparable, higher rates in Illinois would not necessarily have been surprising. It is likely that most distributors in Wisconsin have been working with Focus on Energy for more than two years. If this is the case, then these distributors probably would have intensified their promotion of energy-efficient units several years ago, well before more recent advances in neighboring Illinois. Stable promotional levels in Wisconsin may well be higher than growing levels in Illinois.

The surveys asked a series of questions about stocking practices. Specifically, for each size category, respondents were asked whether they had units that met efficiency criteria in stock. Table 3-24 presents data on distributor stocking rates in Wisconsin and Illinois. For units less than 65 MBh/5.4 tons, Wisconsin firms accounting for 45 percent of units sold in the past 12 months stocked units that met efficiency standards. For units between 65 MBh/5.4 tons and 134 MBh/11.25 tons, distributors accounting for 43 percent of sales stocked efficient units. For units between 135 MBh/11.25 tons and 239 MBh/20 tons, the figure was 40 percent, and for units in the largest size category the figure was 27 percent.

Table 3-24. Percentage of Units Sold by Firms Stocking Energy-Efficient HVAC Units

Do you currently have units that meet the efficiency criterion in stock? (% yes)	State						1-tailed test of significance	
	Wisconsin			Illinois				
	n	estimate	standard error	n	estimate	standard error	Sig @ 90%	p-value
<65 MBh or <5.4 tons	25	45%	24.3%	25	89%	8.2%	Yes	0.0495
65 - 134 MBh or 5.4 - 11.25 tons	25	43%	23.9%	26	87%	7.9%	Yes	0.0450
135 - 239 MBh or 11.25 - 20 tons	25	40%	23.4%	26	65%	13.2%	No	0.1867
240 - 749 MBh or 20 - 62.4 tons	25	27%	21.5%	25	38%	17.0%	No	0.3414

For units less than 65 MBh/5.4 tons, Illinois distributors accounting for 89 percent of units sold stocked units that met efficiency standards. For units between 65 MBh/5.4 tons and 134 MBh/11.25 tons, distributors accounting for 87 percent of sales stocked efficient units. For units between 135 MBh/11.25 tons and 239 MBh/20 tons, the figure was 65 percent, and for units in the largest size category the figure was 38 percent.

Together, these results indicate that, for every size category, a higher percentage of sales in Illinois were generated by firms with energy-efficient HVAC units in stock than was the case in Wisconsin. For the two smallest size categories, the percentage of units sold by Illinois distributors with energy-efficient stock was 44-percentage-points higher than the level that obtained in Wisconsin. In both cases this difference is significant at the five-percent level (p-value = 0.0495 for units smaller than 65 MBh/5.4 tons, p-value = 0.0450 for units between 65 MBh/5.4 tons and 134 MBh/11.25 tons). Differences with regard to the two largest size categories were not statistically significant. In general, these results are unanticipated insofar as program logic would predict higher stocking rates in Wisconsin than in Illinois.

C. EQUIPMENT AVAILABILITY

Lack of equipment availability, caused by higher sales volumes in Wisconsin than in Illinois, may explain this difference in stocking rates as well as parity in promotional levels. Table 3-25 shows that Wisconsin distributors sold an average of 439 rooftop HVAC units smaller than 65 MBh/5.4 tons over the previous 12 months. On average these distributors sold 962 units between 65 MBh/5.4 tons and 134 MBh/11.25 tons, 299 units between 135 MBh/11.25 tons and 239 MBh/20 tons, and 386 units between 240 MBh/20 tons and 749 MBh/62.4 tons.

Table 3-25. Number of Packaged Commercial Rooftop HVAC Units Sold Over Previous 12 Months

Over the past 12 months, how many packaged commercial rooftop HVAC units did you sell?	State						2-tailed test of significance	
	Wisconsin			Illinois				
	n	estimate (avg)	standard error	n	estimate (avg)	standard error	Sig @ 90%	p-value
<65 MBh or <5.4 tons	25	439	73.0	25	75	20.7	Yes	0.0001
65 - 134 MBh or 5.4 - 11.25 tons	25	962	246.0	26	50	14.4	Yes	0.0011
135 - 239 MBh or 11.25 - 20 tons	25	299	93.6	26	52	11.9	Yes	0.0152
240 - 749 MBh or 20 - 62.4 tons	25	386	205.0	26	21	15.3	Yes	0.0887

Average sales volumes for Illinois were much smaller. On average, Illinois firms sold 75 units smaller than 65 MBh/5.4 tons, 51 units between 65 MBh/5.4 tons and 134 MBh/11.25 tons, 53 units between 135 MBh/11.25 tons and 239 MBh/ 20 tons, and 21 units between 240 MBh/20 tons and 749 MBh/62.4 tons.

Table 3-25 demonstrates that Wisconsin sales were significantly larger than Illinois sales. In the smallest size category, Wisconsin firms sold 364 more rooftop units than their Illinois counterparts, and this was significant at the one-percent level (p-value = 0.0001). For the

second smallest size category, Wisconsin firms sold 911 more units, a significant difference at the one-percent level (p-value = 0.0011). For the next category, distributors in Wisconsin sold 246 more units, also significant at the one-percent level (p-value = 0.0152). And for the largest size category, Wisconsin firms sold 365 more units than Illinois firms, which was significant at the five-percent level (p-value = 0.0443). The reasons for this comprehensive sales differential are unclear. Greater sales in Wisconsin may be a result of sustained promotion of energy-efficiency models spurred by Focus on Energy. The program may be generating some other, undetected market effect(s) that is contributing to higher sales volumes. Or the responses of a few very large Wisconsin distributors and the absence of responses from a corresponding set of large Illinois distributors are skewing the results.

Given the sizeable percentage of units sold in Wisconsin that met energy-efficiency standards (from 29 percent to 62 percent, depending on size category), as well as the relative scarcity of such units in the HVAC market, it is probable that Wisconsin distributors stocked at lower levels not because they had little interest in stocking efficient units, but rather because they had difficulty obtaining efficient units to stock. If equipment scarcity was traceable to high consumer demand, and high demand was attributable to Focus on Energy, then it can be argued that the program did in fact impact vendor behavior, though in ways opposite those predicted by the program model. Conceivably, stocking levels were depressed due to the hot market for high-efficiency RTUs, and without the program might have been closer to those that obtained in Illinois. Promotional levels would have been even higher in Wisconsin if more efficient equipment had been available for firms to promote, although such promotion was already extreme in the state.

D. PROGRAM INFLUENCE

Wisconsin distributors representing 99 percent of sales claimed to be aware of the Business Programs. Of these distributors, firms representing 97 percent of units sold had supplied HVAC equipment to projects that received program incentives. Specifically, in the previous 12 months these firms sold an average 46.5 (n=17) units that received program rebates.

Wisconsin firms not only participated in the Business Programs, but they affirmed the importance of Focus on Energy in shaping the state's HVAC market. In response to a series of questions about sales trends, Wisconsin firms representing 95 percent of sales replied that the share of high-efficiency packaged HVAC units they sold had increased over the past two years, by an average of 31 percent. The comparable figures for Illinois firms were 75 percent and 31 percent, respectively. Further, Wisconsin distributors representing 92 percent of units sold said that the market share of energy-efficient RTUs would have been lower in the absence of Focus on Energy. More generally, when asked to rate the overall influence of Focus on Energy on the market share of energy-efficient HVAC units on a scale of 1 to 10, where 1 is no influence and 10 is a great deal of influence, Wisconsin distributors assigned the program an average score of 8.0.

The program has promoted this technology for many years through prescriptive incentives, training, and the distribution of information. However, the BP HVAC Channel was not launched until 2006, followed by an intensified promotion FY08 with two important changes. The program tripled the incentive and transferred the focus of its marketing efforts to promote the technology from the end-use customers to the trade allies. These recent and dramatic changes to BP HVAC promotion may have contributed to the trades' positive view of Focus effect on the market.

E. COST DIFFERENCES

Firms in both states were asked to estimate the typical cost difference between efficient units and standard units. Cost differences in Wisconsin and Illinois are presented in Table 3-26. In Wisconsin, the difference was $233 for units less than 65 MBh/5.4 tons, $227 for units between 65 MBh/5.4 tons and 134 MBh/11.25 tons, $352 for units between 135 MBh/11.25 tons and 239 MBh/20 tons, and $56 for units between 240 MBh/20 tons and 749 MBh/62.4 tons. In Illinois, the difference was $66 for units less than 65 MBh/5.4 tons, $49 for units between 65 MBh/5.4 tons and 134 MBh/11.25 tons, $35 for units between 135 MBh/11.25 tons and 239 MBh/20 tons, and $36 for units between 240 MBh/20 tons and 749 MBh/62.4 tons.

Table 3-26. Cost Differences Between Efficient and Standard HVAC Units

Last year what was the typical difference in cost between units that met this efficiency criterion and those that did not? (efficiency criterion provided for each size category)	State						2-tailed test of significance	
	Wisconsin			Illinois				
	n	estimate (avg)	standard error	n	estimate (avg)	standard error	Sig @ 90%	p-value
<65 MBh or <5.4 tons (11.6 EER or higher)	23	$ 232.93	$ 134.72	24	$ 65.54	$ 29.70	No	0.2379
65 - 134 MBh or 5.4 - 11.25 tons (11.5 EER or higher)	21	$ 227.01	$ 119.30	23	$ 49.37	$ 10.67	No	0.1536
135 - 239 MBh or 11.25 - 20 tons (11.5 EER or higher)	18	$ 351.60	$ 207.15	19	$ 34.90	$ 11.65	No	0.1453
240 - 749 MBh or 20 - 62.4 tons (10.5 or higher)	9	$ 55.89	$ 35.63	9	$ 35.49	$ 9.02	No	0.5942

A two-tailed test of significance demonstrates that none of the cost differentials between these two states is statistically significant. Nevertheless, these differentials were unexpectedly high. For the smallest size category, the cost difference in Wisconsin was $167.39 greater than the cost difference in Illinois, for the second smallest category, the differential was $177.60, and for the second largest category, the cost differential was $316.70.

These results appear puzzling. The purpose of program incentives is precisely to reduce the effective cost of efficient HVAC technology relative to standard equipment, thereby making it more competitive and increasing its market share. But these data suggest that the reverse may be occurring, with rebates helping to widen the cost gap between energy-efficient and conventional equipment.

One possible explanation might be that HVAC distributors in Wisconsin have altered their pricing strategies in order to capture at least part of the value of program rebates. Instead of the end-user receiving incentives to offset a portion of the cost of efficient HVAC units, part of the value of these incentives may have shifted upstream to a higher point in the supply chain, namely, distributors. HVAC distributors may have increased their prices in the knowledge that end-users would be compensated in the form of rebates. If distributors pursued this strategy, the final, rebate-adjusted cost of efficient units for consumers would be comparable to what would obtain without the program rebates, while distributors would increase their revenues. It is also possible that distributor prices simply reflected the adoption of this sort of manipulative pricing strategy at an even higher point in the supply chain, for example, HVAC manufacturers.

Although the survey question[10] specifically ask for the price difference by unit it is possible that some of the trade allies misinterpreted the question and reported their answers in terms

[10] FOR EACH SIZE CATEGORY: “Last year what was the typical difference in cost between units that met this efficiency criterion and those that did not?”

of tons rather than the price per unit. The pricing results should be viewed with caution. The price differential survey question will be further clarified in future surveys.

It is worth repeating that cost differentials between Wisconsin and Illinois were found not to be statistically significant. At the same time, it would be imprudent to dismiss completely the evident contrast between the two states. Other explanations might also account for this difference. For instance, the relatively low levels of high-efficiency units in stock in Wisconsin might mean that comparatively more of these units are purchased through special orders. Special orders are normally priced higher than regular orders of stocked items, and this may be responsible for contrasting cost differentials. While determining the reason(s) behind these cost differences is beyond the scope of the present research, given the degree to which price fixing of any sort would undermine the integrity of the program, further examination of this issue may be warranted.[11]

3.3 ROTARY METRICS

Establishing metric baselines for the Rotary Channel proved to be a particularly challenging endeavor, given several aspects peculiar to the market for Variable Frequency Drives (VFDs). First, in contrast to the Lighting and BP HVAC Channels, two distinct contract metrics, one for compressed air systems and the other for industrial pumps and fans, were selected for baseline measurement. Second, from an early stage, the evaluation team recognized that important differences distinguished pump applications from fan applications, so that it was necessary to assess VFD use separately for each of these technologies. In essence, three different VFD applications, for compressed air systems, pumps, and fans, merited investigation, and measuring baseline values for each application required unique calculations and methodological refinements.

Third, due both to the relative importance of the stock of VFD-eligible systems compared to the flow of such systems, and to the projected low incidence of large compressed air systems in Wisconsin and Illinois, the evaluation team gathered additional data on VFD saturation levels for all production motor applications in order to develop a more complete sense of VFD market share. This supplementary metric entailed its own unique methodological approach.

Despite these complications, data were collected and baseline values estimated for a total four metrics (compressed air systems, industrial fans, industrial pumps, overall VFD saturation levels), and additional findings on VFD use in the Rotary Channel were uncovered and elaborated. The unique methodological issues pertaining to the Rotary Channel are discussed throughout Section 3.3, and are addressed in particular detail in Section 3.3.2 below.

3.3.1 Metric Results

A. PRIMARY METRICS

The program selected VFDs as the subject of the Rotary Channel market effects metrics. The program has promoted this technology through custom incentives, training, and the distribution of information since program inception. In FY07, the program started offering

[11] KEMA is currently conducting a Focus on Energy incremental cost study, and plans to investigate the Wisconsin HVAC cost differences as part of that research effort.

prescriptive incentives for VFD controlled compressed air systems and VFD controlled industrial pumps and fans systems. The *Channel Studies* examined industrial customer adoptions of VFDs in compressed air systems and in pump and fan systems. Table 3-27 shows the critical metrics as they appear in the contract along with a summary of the operational definitions of these metrics.

Table 3-27. Rotary Contract Metric Baseline Approach

Channel	Critical Metric	Summary of Operational Definition
Rotary	Increase in net Wisconsin market share of VFD controlled compressed air systems, compared to increase in net market share from Illinois baseline.	% of compressed air systems controlled by VFDs.
	Increase in net Wisconsin market share of VFD controlled industrial pump and fan flows, compared to increase in net market share from Illinois baseline.	% of fans and blowers controlled by VFDs. % of pumps controlled by VFDs.

In developing operational definitions of the VFD metrics, the evaluation team took into account the following:

- It would be difficult to develop a sense of 'market share' for VFDs on the basis of information on current purchases alone. The vast majority of VFDs are purchased for retrofit onto existing or replacement systems. Thus the 'denominator' of interest for market share consists not only of the *flow* of motors purchased to drive appropriate loads in a given period, but of the *stock* of systems in place that could be fitted with VFDs as well. Also, in the course of one or two years, a company that has generally adopted VFDs may not purchase any if they do not have the occasion to add or replace motors driving the appropriate kinds of load. To address this situation, we included items in the questionnaire that probed saturation of VFDs as well as current purchases of VFD controls. The results of the VFD saturation question sequence are provided below in the Supplemental Metrics section.
- The incidence of large compressed air systems in the factories of any one state is fairly low. While it is true that these systems account for a large portion of motor energy (over 15 percent nation-wide), this motor energy tends to be concentrated in large systems in a small number of plants. For example, in operating NYSERDA's compressed air program for some years, KEMA found that there were only about 100–125 facilities in New York state that had plant compressed air systems sufficiently large to warrant extensive energy-oriented retrofits. The evaluation team expected the incidence of large compressed air systems to be higher in Wisconsin and Illinois, given the high presence of primary and fabricated metal and machinery plants. However, without extensive screening, the number of plant compressed air systems that ended up in a sample of 200 was likely to be low. To address this situation, we broadened the metric to include the use of VFDs on all appropriate loads. These additional VFD saturation results are provided below in the Supplemental Metric section.

With these considerations in mind, the rotary metrics were estimated using surveys of industrial end-users of VFDs. Industrial end-users were selected as the target market group because they constitute the most readily identifiable group with detailed knowledge of VFD applications. Distributors are normally unaware of such applications. Vendors/contractors, while more knowledgeable about VFD uses, are a diverse and diffuse group of actors. Only motor end-users are simultaneously informed and easily identifiable.

The survey question sequence and metric baselines are provided separately for compressed air systems, industrial fans, and industrial pumps. The complete versions of the Wisconsin and Illinois VFD End-User Surveys are provided in Appendix E and F, respectively.

i. Compressed Air Systems

Table 3-28 shows the sequence of questions used to construct the VFDs in compressed air metric.

Table 3-28. Rotary Contract Metric Survey Sequence
VFDs in Compressed Air Systems

Survey Question #	Survey Question Text
3.3, 3.5, 3.7[a]	What is the horsepower rating of the compressor?
3.4, 3.6, 3.8 [a]	Is this compressor fitted with a variable frequency drive?

[a]Survey questions asked are dependent on the number of compressors at the facility. KEMA collected data for up to the eight largest compressors per end user. Only one respondent in Wisconsin and one respondent in Illinois indicated they had more than eight compressors.

The results of these questions were used to estimate baseline values for both Wisconsin and Illinois. Baseline values were calculated as the ratio of the sum of horsepower weighted air compressors with VFDs to the sum of horsepower weighted air compressors. A more detailed explanation of the ratio estimation technique is provided in Section 3.3.2 “Detailed Approach.” Table 3-29 presents the metrics baseline estimates for Wisconsin and Illinois. For Wisconsin, 18 percent of compressed air systems were fitted with VFDs. For Illinois, 13 percent of systems were fitted with VFDs. The relatively small sample obtained by the surveys, particularly in Illinois (n = 103), effectively precluded disaggregating the results in terms of horsepower size category. Instead, the evaluation team weighted compressors by horsepower in order to take account of size variation.

Table 3-29. Rotary Contract Metric Baseline:
VFDs in Compressed Air Systems

VFD Compressed Air Metric	State	n	Baseline Estimate	Standard Error	90% Confidence Interval	
					Lower Bound	Upper Bound
Percent of compressed air system hp fitted with VFDs	Wisconsin	170	18%	6.7%	6.4%	28.7%
	Illinois	103	13%	5.0%	4.8%	21.5%

As Table 3-30 shows, the metric baselines for VFDs used in compressed air systems in Wisconsin and Illinois are similar. The five-percentage-point difference between these two estimates is not statistically significant at the ten percent level of significance. A one-tailed test of significance was used for this metric because we expected to see a larger proportion in Wisconsin compared Illinois.

**Table 3-30. Rotary Contract Metric Baseline Comparison:
VFDs in Compressed Air Systems**

VFD Compressed Air Metric	p-value	Significance Level			
		90%	95%	99%	2-tailed or 1-tailed test
Percent of compressed air system hp fitted with VFDs	0.3022	No	No	No	1-tailed test

ii. Industrial Fans

Table 3-31 shows the sequence of questions used to construct the VFDs in fan and blower systems metric.

**Table 3-31. Rotary Contract Metric Survey Sequence
VFDs in Fan and Blower Systems**

Survey Question #	Survey Question Text
4.3	Approximately what percentage of the total horsepower of your fan and blower systems falls in the [READ SIZE CATEGORY] category? [Size Categories: a. 1 – 5 hp b. 6 – 10 hp c. 11 – 50 hp d. > 50 hp]
4.4	[FOR EACH SIZE CATEGORY ASK:] And what percentage of the fans and blowers in that category are controlled by VFDs?

The results of these questions were used to estimate baseline values for both Wisconsin and Illinois. Baseline values were calculated as the ratio of employment weighted percent of fans and blowers controlled by VFDs to employment-weighted percent of total installed horsepower. A more detailed explanation of the ratio estimation technique is provided in Section 3.3.2, "Detailed Approach." Tables 3-32 and 3-33 present the metrics baselines estimates for Wisconsin and Illinois, respectively. In Wisconsin, there is little variation in the fraction of fans and blowers fitted with VFDs. The baseline estimates range from 6 percent in the greater than 50 hp size category to 12 percent in the 6–20 hp and 21–50 hp size categories. The Illinois baselines range from 2 percent in the greater than 50 hp size category to 15 percent in the 6–20 hp size category.

Table 3-32. Rotary Contract Metric Baseline: Wisconsin
VFDs in Fan and Blower Systems

Wisconsin						
					90% Confidence Interval	
VFD Fan or Blower System Metric	Size Category	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of fans and blowers fitted with VFDs	1 - 5 hp	99	7%	2.9%	1.9%	11.5%
	6 - 20 hp	100	12%	4.7%	4.3%	20.1%
	21 - 50 hp	97	12%	3.0%	6.7%	16.6%
	> 50 hp	96	6%	3.0%	1.3%	11.3%
	Total	101	8%	2.0%	4.4%	11.2%

Table 3-33. Rotary Contract Metric Baseline: Illinois
VFDs in Fan and Blower Systems

Illinois						
					90% Confidence Interval	
VFD Fan or Blower System Metric	Size Category	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of fans and blowers fitted with VFDs	1 - 5 hp	56	11%	8.0%	0.0%	24.5%
	6 - 20 hp	54	15%	7.3%	2.6%	27.1%
	21 - 50 hp	53	5%	5.0%	0.0%	13.7%
	> 50 hp	53	2%	2.3%	0.0%	6.3%
	Total	56	10%	4.7%	2.3%	18.0%

As Table 3-34 shows, the metric baselines for VFDs used in fan and blower systems in Wisconsin and Illinois are similar. The baseline estimates for each size category and the total are not statistically different from each other at the ten-percent level of significance. A one-tailed test of significance was used for this metric because we expected to see a larger proportion in Wisconsin compared Illinois.

Table 3-34. Rotary Contract Metric Baseline Comparison
VFDs in Fan and Blower Systems

			Significance Level			
VFD Fan or Blower System Metric	Size Category	p-value	90%	95%	99%	2-tailed or 1-tailed test
Percent of fans and blowers fitted with VFDs	1 - 5 hp	0.3000	No	No	No	1-tailed test
	6 - 20 hp	0.3816	No	No	No	1-tailed test
	21 - 50 hp	0.1401	No	No	No	1-tailed test
	> 50 hp	0.1563	No	No	No	1-tailed test
	Total	0.3184	No	No	No	1-tailed test

iii. Industrial Pumps

Table 3-35 shows the sequence of questions used to construct the VFDs in pump systems metric.

Table 3-35. Rotary Contract Metric Survey Sequence
VFDs in Pump Systems

Survey Question #	Survey Question Text

Survey Question #	Survey Question Text
4.7	Approximately what percentage of the total horsepower of your pump systems falls in the [READ SIZE CATEGORY] category? [Size Categories: a. 1 – 5 hp b. 6 – 20 hp c. 21 – 50 hp d. 51 – 100 e. > 100 hp]
4.8	[FOR EACH SIZE CATEGORY ASK:] And what percentage of the pumps in that category are controlled by VFDs?

The results of these questions were used to estimate baseline values for both Wisconsin and Illinois. Baseline values were calculated as the ratio of employment-weighted percent of pumps controlled by VFDs to employment-weighted percent of total installed horsepower. A more detailed explanation of the ratio estimation technique is provided in Section 3.3.2, "Detailed Approach." Tables 3-36 and 3-37 present the metrics baselines estimates for Wisconsin and Illinois, respectively. In Wisconsin, the fraction of pumps fitted with VFDs tends to be larger for the larger pump systems. Twenty-two percent of pumps in the 20–100 hp size category and over half of the pumps in the greater than 100 hp size category are fitted with VFDs. The Illinois baseline estimates have the opposite trend, with less than one percent of motors in the greater then 100 hp size category and 29 percent of the pumps in the 1–5 hp size categories.

Table 3-36. Rotary Contract Metric Baseline: Wisconsin
VFDs in Pump Systems

Wisconsin						
					90% Confidence Interval	
VFD Pump System Metric	Size Category	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of pumps fitted with VFDs	1 - 5 hp	94	8%	3.7%	2.2%	14.5%
	6 - 20 hp	94	18%	8.2%	4.7%	32.1%
	21 - 50 hp	92	10%	3.5%	4.1%	15.8%
	50 - 100 hp	92	22%	10.8%	3.5%	39.5%
	> 100 hp	92	52%	19.9%	19.4%	85.4%
	Total	94	15%	4.5%	7.4%	22.2%

Table 3-37. Rotary Contract Metric Baseline: Illinois
VFDs in Pump Systems

Illinois						
VFD Pump System Metric	Size Category	n	Baseline Estimate	Standard Error	90% Confidence Interval Lower Bound	90% Confidence Interval Upper Bound
Percent of pumps fitted with VFDs	1 - 5 hp	67	29%	11.5%	9.6%	48.1%
	6 - 20 hp	65	10%	4.5%	3.0%	18.0%
	21 - 50 hp	65	7%	4.8%	0.0%	15.3%
	50 - 100 hp	65	5%	3.6%	0.0%	11.4%
	> 100 hp	65	0%	0.1%	0.0%	0.4%
	Total	67	16%	4.9%	7.4%	23.8%

Table 3-38 shows a statistical comparison of the VFDs in pump system metric baselines for Wisconsin and Illinois. The smallest and largest categories are statistically difference from each other at least at the ten-percent level of significance. A one-tailed test of significance was used for this metric because we expected to see a larger proportion in Wisconsin compared Illinois. For the 1–5 hp size category, the Illinois baseline estimate is significantly larger, while for the 50–100 hp and the greater than 100 hp size categories the Wisconsin baseline estimates are significantly larger. A closer look at the data reveals that large pumps are more prevalent in the Wisconsin market compared to Illinois. There were no Illinois respondents in the Pulp and Paper Industry SIC with pumps systems in the > 100 hp category.

Table 3-38. Rotary Contract Metric Baseline Comparison
VFDs in Pump Systems

VFD Pump System Metric	Size Category	p-value	Significance Level 90%	95%	99%	2-tailed or 1-tailed test
Percent of pumps fitted with VFDs	1 - 5 hp	0.0479	Yes	Yes	No	1-tailed test
	6 - 20 hp	0.2009	No	No	No	1-tailed test
	21 - 50 hp	0.3340	No	No	No	1-tailed test
	50 - 100 hp	0.0816	Yes	No	No	1-tailed test
	> 100 hp	0.0054	Yes	Yes	Yes	1-tailed test
	Total	0.4504	No	No	No	1-tailed test

B. SUPPLEMENTARY METRICS

KEMA expanded the scope of the VFD metric assessment to develop a more complete sense of the market share for VFDs. The questionnaire included questions that collect VFD saturation levels for all production motor applications rather than limiting to current purchases or only compressed air, pump, and fan systems. Table 3-39 shows the sequence of questions used to determine VFDs saturation levels.

Table 3-39. Supplemental Rotary Contract Metric Survey Sequence
VFD Saturation Levels

Survey Question #	Survey Question Text

Survey Question #	Survey Question Text
2.1	First, can you tell me roughly how many motors you have in your facility? We are interested in motors that run the production equipment; not those used in space conditioning systems? [Size Categories: a. 1 – 20 hp b. 21 – 50 hp c. 51 – 100 hp d. 101 – 200 hp e. > 200 hp
2.2[a]	How many of these motors are greater than 200 horsepower?
2.2.a	How many of these motors over 200 horsepower drive variable loads?
2.2.b	And how many of these motors are fitted with variable frequency drives or VFDs?
2.6[b]	What percent of your production motors from 1 to 20 horsepower drive variable loads?
2.6.a	And what percent of these motors are fitted with variable frequency drives?

[a]Similar question sequence (2.2, 2.2.a, 2.2.b) is asked for each of the five size categories. Refer to Appendix E and F for the full question series.
[b]The saturation questions were asked in terms of percent rather than counts for the 1 to 20 horsepower size category.

The results of these questions were used to estimate baseline values for both Wisconsin and Illinois. KEMA employed ratio estimation to calculate to the baseline values. The *Percent of Motors with VFDs* was calculated as the ratio of the sum of VFDs to the sum of motors; and the *Percent of Variable Loads with VFDs* was calculated as the ratio of the sum of VFDs to the sum of variable loads. A more detailed explanation of the ratio estimation technique is provided in Section 3.3.2, "Detailed Approach." Tables 3-40 and 3-41 present Wisconsin metric baseline estimates for motors greater than 20 hp and less than 20 hp, respectively. The less than 20 hp size category question was asked in terms of percent rather than count because it is easier for respondent to answer. The greater the number of motors at a facility the harder it is for respondents to provide counts of motors and associated VFDs.

In Wisconsin, 38 percent of motors between 21 hp and 50 hp were equipped with VFDs, 65 percent of motors 51–100 hp, 58 percent of motors 101–200 hp, and 44 percent of motors over 200 hp. With respect to variable loads, 76 percent of variable loads on motors 21–50 hp used VFDs. For motors 51–100 hp, 76 percent of variable loads used VFDs, for motors 101–200 hp, 72 percent of variable loads used VFDs, and for motors greater than 200 hp, 61 percent of variable loads were controlled by VFDs.

Table 3-40. Rotary Contract Metric Baseline: Wisconsin
VFD Saturation Levels (>20 hp)

Wisconsin						
					90% Confidence Interval	
VFD Saturation	Size Category	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of motors with VFDs.	21 - 50 hp	85	38%	5.0%	30.2%	46.7%
	51 - 100 hp	67	65%	11.7%	45.2%	84.3%
	101 - 200 hp	64	58%	9.0%	42.9%	72.9%
	>200 hp	36	44%	8.5%	29.8%	58.5%
Percent of variable loads with VFDs.	21 - 50 hp	86	76%	5.5%	66.5%	84.8%
	51 - 100 hp	67	84%	8.8%	69.7%	99.1%
	101 - 200 hp	64	72%	10.5%	54.0%	89.1%
	>200 hp	37	61%	10.6%	42.8%	78.5%

Table 3-40 shows Wisconsin saturation levels for motors smaller than 20 hp. Within this size category, 37 percent of motors drive variable loads, and 21 percent of motors used VFDs.

Table 3-41. Rotary Contract Metric Baseline: Wisconsin
VFD Saturation Levels (<20 hp)

Wisconsin					
				90% Confidence Interval	
VFD Saturation	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of 1 - 20 hp motors with variable loads	169	37%	13.4%	14.8%	59.2%
Percent of 1 - 20 hp motors with VFDs	129	21%	6.3%	10.3%	31.1%

Illinois VFD saturation levels for motors greater than 20 hp and less than 20 hp are detailed in Tables 3-42 and 3-43, respectively. For motors 21–50 hp, 35 percent of motors used VFDs. For motors 51–100 hp, 29 percent were controlled by VFDs, and for motors greater than 200 hp, 30 percent were controlled by VFDs. Less than one percent of motors between 101 hp and 200 hp were equipped with VFDs. With respect to variable loads, within the size category 21–50 hp, 71 percent of variable loads were equipped with VFDs. For motors 51–100 hp, 52 percent of variable loads used VFDs, for motors 101–200 hp, 25 percent of variable loads used VFDs, and for motors greater than 200 hp, 63 percent of variable loads used VFDs.

Table 3-42. Rotary Contract Metric Baseline: Illinois
VFD Saturation Levels (>20 hp)

Illinois						
					90% Confidence Interval	
VFD Saturation	Size Category	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of motors with VFDs.	21 - 50 hp	35	35%	13.6%	12.4%	58.2%
	51 - 100 hp	25	29%	4.4%	21.0%	36.1%
	101 - 200 hp	26	0%	0.3%	0.0%	0.8%
	>200 hp	15	30%	8.5%	15.3%	45.1%
Percent of variable loads with VFDs.	21 - 50 hp	35	71%	12.0%	50.8%	91.3%
	51 - 100 hp	28	52%	10.4%	34.3%	69.8%
	101 - 200 hp	28	25%	3.5%	19.4%	31.3%
	>200 hp	16	63%	18.5%	30.9%	95.6%

For Illinois motors smaller than 20 hp, 35 percent of motors drive variable loads, and 13 percent of motors used VFDs.

Table 3-43. Rotary Contract Metric Baseline: Illinois
VFD Saturation Levels (<20 hp)

Illinois					
				90% Confidence Interval	
VFD Saturation	n	Baseline Estimate	Standard Error	Lower Bound	Upper Bound
Percent of 1 - 20 hp motors with variable loads	119	35%	3.1%	29.9%	40.1%
Percent of 1 - 20 hp motors with VFDs	87	13%	3.0%	8.4%	18.4%

Table 3-44 offers a comparison of saturation level baseline values for motors greater than 20 hp. A one-tailed test of significance was used for these metrics because we expected to see a larger proportion of VFDs in Wisconsin compared Illinois. With respect to motor VFD saturation levels, differences in metric values between Wisconsin and Illinois were not statistically significant either for motors between 21 hp and 50 hp, or for motors greater than 200 hp. However, for motors 51–100 hp, the 36-percentage-point higher saturation rate in Wisconsin compared to Illinois was significant at the one-percent level (p-value < 0.0041). Similarly, for motors 101–200 hp, a size category in which less than one percent of Illinois end-users fitted motors with VFDs, Wisconsin's saturation level of 58 percent was significantly higher at the one-percent level (p-value < 0.0001).

Table 3-44. Rotary Contract Metric Baseline Comparison
VFD Saturation Levels (>20 hp)

			Significance Level			
VFD Saturation	Size Category	p-value	90%	95%	99%	2-tailed or 1-tailed test
Percent of motors with VFDs.	21 - 50 hp	0.4140	No	No	No	1-tailed test
	51 - 100 hp	0.0041	Yes	Yes	Yes	1-tailed test
	101 - 200 hp	<0.0001	Yes	Yes	Yes	1-tailed test
	>200 hp	0.1324	No	No	No	1-tailed test
Percent of variable loads with VFDs.	21 - 50 hp	0.3651	No	No	No	1-tailed test
	51 - 100 hp	0.0125	Yes	Yes	No	1-tailed test
	101 - 200 hp	0.0001	Yes	Yes	Yes	1-tailed test
	>200 hp	0.4520	No	No	No	1-tailed test

With respect to variable load saturation levels, differences between Wisconsin and Illinois in the smallest and largest size categories were again insignificant. But for size category 51–100 hp, Wisconsin's 32-percentage-point higher VFD saturation level was significant at the five percent level (p-value = 0.0125). And for size category 101–200 hp, the 47-percentage-point difference between the states was significant at the one-percent level (p-value = 0.0001).

Comparison results for motors smaller than 20 hp are provided in Table 3-45. A one-tailed test of significance was used for the VFD metric because we expected to see a larger proportion of VFDs in Wisconsin compared Illinois. We did not expect a difference in the percent of variable loads across states therefore a two-tailed test was employed. Neither the difference in saturation levels for motors with variable loads between Wisconsin and Illinois, nor the difference in saturation rates for motors with VFDs, was statistically significant at the ten percent level of significance.

Table 3-45. Rotary Contract Metric Baseline Comparison
VFD Saturation Levels (<20 hp)

		Significance Level			
VFD Saturation	p-value	90%	95%	99%	2-tailed or 1-tailed test
Percent of 1 - 20 hp motors with variable loads	0.8846	No	No	No	2-tailed test
Percent of 1 - 20 hp motors with VFDs	0.2984	No	No	No	1-tailed test

Taken together, these results offer strong evidence that Focus on Energy has contributed to greater VFD saturation levels in Wisconsin compared to Illinois. Particularly with regard to motors in size categories 51–100 hp and 101–200 hp, VFDs were used to a significantly larger extent in Wisconsin than in Illinois, both in terms of motor saturation and in terms of variable load saturation. Saturation rates were comparable for motors smaller than 20 hp as well as for motors greater than 200 hp.

3.3.2 Detailed Approach

The four VFD metrics are based on surveys of end-users. Unlike the lighting contractor and HVAC distributor surveys, it is not necessary to adjust end-user responses by the share of the market each represents. However, end-users have different combinations of motors of different sizes, each of which may or may not have a VFD. It is most appropriate to use a combined ratio estimation technique to determine the ratio of total horsepower controlled by VFDs to the total horsepower of motors in each of the four categories: compressed air, fans and blowers, pumps, and production motors.

Survey responses were weighted to reflect the total horsepower in each category in that facility, as well as the population weight of the size stratum from which the firm was drawn. Where the questionnaire sought responses in the form of a number or percentage—for example, the percent of compressed air systems that have VFDs—survey responses were calculated using the combined ratio estimator $\hat{R}_c$:

$$\hat{R}_c = \frac{\sum_h \frac{N_h}{n_h} \sum_i B_{h_i} x_i}{\sum_h \frac{N_h}{n_h} \sum_i x_i}$$

where

i = sample end-user,

N_h = number of end-users in the population in sample stratum h,

n_h = number of end-users in the sample in stratum h,

B_{h_i} = total horsepower of motors in category that are controlled by VFDs (at each end-user i)

x_i = total horsepower of motors in category (at each end-user i)

In effect, the procedure simultaneously estimates the total HP and the HP with VFDs for the whole state, stratified and weighted. This estimate is less subject to sudden shocks (for example, if one respondent has just upgraded the whole production line) than would be a firm-by-firm calculation. It is appropriate for measuring trends over time, across industries and over large areas such as states.

The following is a detailed description of the values we measured for compressed air, fans and blowers, pumps, and production motor metrics.

COMPRESSED AIR

There are comparatively few end-users with large air-compression systems; the metric is defined as the ratio of the total horsepower of the system that is controlled by VFDs, to the sum of total HP of the system. The relevant questions are in section three of the survey instruments (see Appendices D and E). They include "Is there a compressed air system at this location?", "How many compressors are there in the system?", "What is the horsepower rating of the [n^{th}] compressor?" and "Is this compressor fitted with a variable frequency drive?"

The horsepower controlled by VFDs is the sum of the horsepower ratings of motors where the compressor was fitted with a VFD, while the total horsepower was the corresponding unconditional sum of horsepower, as shown in Equation 3-1. These were estimated jointly to get a picture of the industrial population.

Equation 3-1. Calculation of the Compressed Air %VFD Saturation

$$\frac{\text{Sum of Rated HP of Compressor Motors with VFDs}}{\text{Sum of Rated HP of All Compressor Motors}}$$

A. FANS AND BLOWERS

Respondents were asked about the presence of industrial fans and blowers. Those that answered yes were asked about the total horsepower of the fans and blower motors. They were then asked two questions about fan and blower motors by hp size category (1–5 hp, 6–20 hp, 21–50 hp, and over 50 hp). "Approximately what percentage of the total installed hp of your fan and blower systems falls in the X category?" and "And what percentage of the fans and blowers in that category are controlled by VFDs?"

Unfortunately, many respondents who gave detailed answers to the VFD and size questions did not answer the question about the total HP of the fan/blower system. KEMA's experience on other market studies shows that number of employees is a good proxy for size of an operation. We computed the percent of total horsepower in each HP-size category weighted that by the number of full-time employees at that location (see Equation 3-2). We then computed the fraction of that quantity that is controlled by VFDs. We then estimated jointly the two quantities for each of the four size categories, fraction of HP in that category (weighted by number of FTEs), and fraction of that fraction that is controlled by VFDs. We also estimated the sums across those categories to get a general estimate of the fraction of fan and blower HP controlled by VFDs.

Equation 3-2. Calculation of %VFD Saturation for Fan/Blower and Pump Motors

$$\frac{(\text{Fraction of HP w/VFDs}) * (\text{Fraction of HP in Category}) * (\#\text{FTEs})}{(\text{Fraction of HP in Category}) * (\#\text{FTEs})}$$

B. PUMPS

Respondents were asked about the presence of industrial pump systems at that facility. Those who answered yes were asked a series of questions about the pump motors that is identical to the sequence asked about fans and blower motors, although there are five categories: (1–5 HP, 6–20 HP, 21–50 HP, 50–100 HP and over 100 HP). The pump metric calculations are the same as those used for fans and blowers (see Equation 3-2).

C. VFD SATURATION IN PRODUCTION MOTORS

All respondents were asked about the number of production motors (motors used in their production processes) in each of five size categories: For each category, they were asked three questions: "How many motors of X horsepower are in this facility?", "How many of these motors drive variable loads?" and "And how many of these motors are fitted with VFDs?"

Equation 3-3. Calculation of %VFD Saturation for Production Motors > 20 HP

$$\frac{\#\text{ Motors w/VFDs}}{\#\text{ Motors in Category}} \qquad \frac{\#\text{ Motors w/VFDs}}{\#\text{ Motors w/Variable Loads}}$$

From these questions we estimated two ratios (shown in Equation 3-3): the fraction of all motors in the category that have VFDs (the ratio of the first and third questions), and the fraction of all motors driving variable loads that have VFDs (the ratio of the second and third questions). Additionally, we estimated those ratios for all of the motors in all size categories.

For the smallest category, motors from 1–20 hp, we did not ask for counts, because there are likely too many for a respondent to think about each one while on the phone. Instead, we asked for the fraction of motors driving variable loads, and the fraction of those motors fitted with VFDs. Because we asked for these fractions directly, rather than asking for the two quantities and computing the fraction, it is not necessary to use a ratio estimator. We directly estimated the (weighted and stratified) population mean percentages and reported those.

3.3.3 Data Collection

The following points summarize the evaluation team's approach to the design of the sample for the VFD surveys:

- **Sample frame.** The evaluation used the iMarket Database of Dun & Bradstreet data as the sample frame. This database contains a great deal of information on individual building establishments, including name, location, primary and secondary business activities, number of employees, and annual revenues. Information on business activity and number of employees is fairly accurate for establishments with at least ten employees. Moreover, aggregated D&B data for establishments with ten or more employees matches up fairly well with data from other sources, such as the Economic Census and the Bureau of Labor Statistics. For smaller establishments,

which tend to be less stable, coverage and accuracy is less consistent. The study screened all respondents to ensure that they were included in the appropriate stratum and adjusted stratum weights to reflect reallocations of respondents.

- **Target population.** The target population was manufacturing establishments in the eight 2-digit manufacturing SIC categories that account for the bulk of motor systems energy in Wisconsin. KEMA calculated a motor energy per employee factor for each 2-digit SIC group, using the results of the 1998 *Manufacturing Energy Consumption Survey* (MECS 1998). The evaluation team applied this factor to the total number of employees in cells defined by 2-digit SIC and employment size in the Dun & Bradstreet data. We used the resulting tables. The following eight SIC groups account for 87 percent of estimated manufacturing motor systems energy use in Wisconsin: Paper and Allied Products (26), Chemicals and Allied Products (28), Food and Kindred Products (20), Primary Metals (33), Industrial & Commercial Machinery (35), Rubber & Plastic Products (30), Lumber & Wood Products (24), and Fabricated Metal Products (34).

  These same industries account for 78 percent of total motor systems energy use in Illinois. They are not the top eight industries on this dimension. However, because opportunities to use VFDs are related to processes with different saturations in various industries, we chose to keep the SICs consistent in defining the sample frames for the two states.

- **Sample stratification and allocation.** The proposal called for a sample size of 400 combined for the Wisconsin and Illinois samples, or 200 per state. The evaluation team's sampling plan used a stratified approach with the motor energy index described above as the measure of size. In the larger size strata, the sample sizes exhausted the available population.

Data were collected using CATI surveys of industrial end-users of VFDs conducted by Research America. Surveys were conducted in both Wisconsin and Illinois from May 21 through July 25, 2008. The field period was extended from the planned six weeks to nine weeks because of difficulties achieving sample completes in the large company size strata. Table 3-46 and Table 3-47 show the final sample dispositions for the Wisconsin and Illinois samples, respectively. One hundred and ninety surveys were completed with Wisconsin end-users and 134 surveys were completes with Illinois end-users. The target completes were achieved or the sample was exhausted for every stratum in the Wisconsin and Illinois samples.[12] As strata were exhausted KEMA directed Research America to continue seeking completes in achieved strata. Eventually all strata were exhausted with the exception of three small size (1-99 employees) strata. In these three remaining strata, the target completes were surpassed by 25, 16, and 6 completes. Adding completes to these strata would have minimal effect of the precision of the baseline estimates therefore KEMA directed Research America to end data collection.

[12] Information on response rates from the survey house is a planned addition to the final draft.

Table 3-46. Wisconsin VFD End-user Sample Disposition

Industry	Employment Category	% of Total SIC Employment	# of Establishments	Target Completes	# of Completes	Strata Disposition
Paper and Allied Products	1-99	15%	286	17	42	Achieved
	100-500	45%	97	49	33	Exhausted
	500+	40%	24	24	3	Exhausted
Chemical and Allied Products	1-99	40%	567	15	23	Achieved
	100-500	34%	34	16	11	Exhausted
	500+	26%	5	5	2	Exhausted
Food and Kindred Products	1-99	28%	836	6	9	Achieved
	100-500	46%	120	10	10	Achieved
	500+	26%	11	5	2	Exhausted
Primary Metal Industries	1-99	25%	257	5	8	Achieved
	100-500	50%	58	9	9	Achieved
	500+	26%	8	5	2	Exhausted
Machinery and Computer Equipment	1-99	35%	2,514	3	3	Achieved
	100-500	33%	184	3	3	Achieved
	500+	33%	28	3	3	Achieved
Rubber and Plastic Products	1-99	38%	445	4	4	Achieved
	100-500	49%	76	4	5	Achieved
	500+	13%	4	1	3	Achieved
Lumber and Wood Products	1-99	41%	1,589	3	3	Achieved
	100-500	36%	57	3	2	Achieved
	500+	23%	9	2	3	Achieved
Fabricated Metal Products	1-99	37%	1,200	3	3	Achieved
	100-500	44%	120	3	2	Achieved
	500+	19%	8	2	2	Achieved
Total			**8,537**	**200**	**190**	

Table 3-47. Illinois VFD End-user Sample Disposition

Industry	Employment Category	% of Total SIC Employment	# of Establishments	Target Completes	# of Completes	Strata Disposition
Paper and Allied Products	1-99	31%	488	14	20	Achieved
	100-500	45%	87	20	2	Exhausted
	500+	24%	6	11	0	Exhausted
Chemical and Allied Products	1-99	25%	1,159	22	38	Achieved
	100-500	34%	121	31	4	Exhausted
	500+	41%	15	36	0	Exhausted
Food and Kindred Products	1-99	21%	1,215	5	17	Achieved
	100-500	39%	168	9	6	Exhausted
	500+	40%	35	9	0	Exhausted
Primary Metal Industries	1-99	34%	509	5	14	Achieved
	100-500	44%	70	7	2	Exhausted
	500+	22%	7	3	0	Exhausted
Machinery and Computer Equipment	1-99	48%	3,977	3	2	Exhausted
	100-500	37%	218	2	6	Achieved
	500+	15%	21	1	0	Exhausted
Rubber and Plastic Products	1-99	38%	881	4	3	Exhausted
	100-500	45%	128	5	7	Achieved
	500+	18%	9	2	1	Exhausted
Lumber and Wood Products	1-99	75%	1,589	2	2	Achieved
	100-500	16%	57	0	0	Achieved
	500+	9%	9	0	0	Achieved
Fabricated Metal Products	1-99	46%	1,200	4	4	Achieved
	100-500	37%	120	3	6	Achieved
	500+	17%	8	2	0	Exhausted
Total			**12,097**	**200**	**134**	

The end-user interviews addressed a number of topics, including motor use, VFD applications in compressed air systems, and applications relating to industrial fans and pumps. Key information gathered by the surveys included:

- Number of VFDs purchased in past two years
- Number and horsepower of compressors in compressed air systems fitted with VFDs
- Influence of Focus on Energy on installation of VFDs in compressed air systems (for Wisconsin respondents)
- Percentage of fan and blower systems controlled by VFDs
- Percentage of pump systems controlled by VFDs
- Influence of Focus on Energy on use of VFDs in fan, blower, and pump systems (for Wisconsin respondents).

3.3.4 Detailed Findings

In Section 3.3.1, KEMA reported the baseline estimates for compressed air, fans and blowers, pumps, and production motor metrics. In this section, we take a closer look at the results and explore the differences between the Wisconsin and Illinois markets for VFD technology. We begin with a closer inspection of recent VFD purchases, then consider compressed air systems, and conclude with a detailed discussion of pumps and fans.

A. RECENT VFD PURCHASES

We asked end-users a series of questions about recent purchases of VFDs. Thirty-one percent of Wisconsin end-users and 17 percent of Illinois end-users purchased a VFD in the past two years. Table 3-48 shows that, on average, Wisconsin end-users bought eleven VFDs for motors in size category 1–20 hp, eight VFDs for motors in size category 21–50 hp, and one VFD in each of the remaining categories.

Table 3-48. Number of VFDs Purchased in Past Two Years, According to Size Category

How many of the VFDs purchased in the past two years are fitted to motors in the following size categories	State						1-tailed test of significance	
	Wisconsin			Illinois				
	n	estimate (avg)	standard error	n	estimate (avg)	standard error	Sig @ 90%	p-value
1 - 20 hp	99	11.1	1.6	52	18.9	10.0	No	0.2229
21 - 50 hp	100	7.9	5.2	56	16.1	9.0	No	0.2190
51 - 100 hp	100	0.9	0.3	57	9.2	4.4	Yes	0.0328
101 - 200 hp	102	0.3	0.1	56	4.2	3.6	No	0.1388
> 200 hp	103	1.1	0.8	57	1.1	0.9	No	0.4938

On average, Illinois consumers purchased 19 VFDs for motors in size category 1–20 hp and 16 VFDs for motors in size category 21–50 hp. Purchasing rates were lower for larger size categories, with an average of nine VFDs purchased for motors 51–100 hp, four purchased for motors 101–200 hp, and one VFD purchased for motors greater than 200 hp.

Purchase rates across states are similar with the exception of the 51–100 hp size categories. Illinois end-users bought an average eight more VFDs for use with these motors than did Wisconsin end-users. This difference is significant at the five percent level (p-value = 0.0328). In both states, the number of VFDs purchased tended to decline as motor size increased.

Further, both states exhibited a wide range of VFD-fitted motor applications across all size categories, including blowers, compressors, conveyors, fans, grinders, mixers, presses, and pumps.

Table 3-49 presents responses given to a question concerning the extent to which end-users took advantage of opportunities to benefit from VFDs. Among Wisconsin VFD end-users, 21 percent claimed to take advantage of all available opportunities to benefit from VFDs and 14 percent claimed to take advantage of most opportunities, while 44 percent responded that they had taken advantage of none of these opportunities. For those who had taken advantage of all or most opportunities, 59 percent cited "energy savings" as the most important reason to use VFDs, followed by "increased productivity" at 18 percent. For Wisconsin end-users who did not take advantage of all or most opportunities, 55 percent cited, "cost was too high" as the primary reason, followed by 18 percent who said they were, "not aware of VFDs."

Table 3-49. VFD Opportunities Taken Advantage Of

Do you believe that you company has taken advantage of…	State				2-tailed test of significance	
	Wisconsin		Illinois			
	estimate	standard error	estimate	standard error	Sig @ 90%	p-value
All available opportunities to benefit from VFDs	21%	11.3%	9%	3.1%	No	0.3021
Most of those opportunities	14%	5.1%	15%	3.3%	No	0.9492
Some of those opportunities	10%	2.4%	9%	3.0%	No	0.8601
Few of those opportunities	7%	2.1%	6%	2.9%	No	0.8690
None of those opportunities	48%	11.2%	61%	3.2%	No	0.2671
# Respondents	176		122			

Among Illinois end-users, nine percent took advantage of all opportunities to benefit from VFDs and 15 percent took advantage of most opportunities. In contrast, 61 percent replied that they took advantage of no opportunities. Among Illinois respondents who took advantage of all or most opportunities, "energy savings" was named as the most important reason to do so by 36 percent of end-users, followed by "increased productivity" at 31 percent. For respondents who did not take advantage of opportunities at high levels, 47 percent attributed this to the fact that they were "not aware of VFDs," while 27 percent cited "not enough motor operating hours to justify investment."

The survey also contained questions about NEMA Premium Efficiency motors. Specifically, Wisconsin end-users purchased an average 4.0 AC electric motors between 1 and 200 hp over the previous year, and 29 percent of these motors were rated NEMA Premium Efficiency. Illinois end-users bought an average 9.8 AC motors in this horsepower range, and 32 percent were rated NEMA Premium Efficiency. Among end-users who either had not purchased AC motors in this horsepower range, or did purchased AC motors in this horsepower range but unsure whether the unit purchased was rated as NEMA Premium Efficiency, only 15 percent of Wisconsin respondents had heard of NEMA Premium Efficiency motors, while just 9 percent of Illinois respondents were so informed.

B. COMPRESSED AIR

On the subject of VFD use in compressed air systems, 98 percent of Wisconsin end-users had such systems on site, compared to 95 percent of Illinois end-users. These systems had a similar number of compressors in each state as well, with an average 1.9 in Wisconsin and 1.5 in Illinois.

Wisconsin respondents were asked a set of questions regarding the impact of Focus on Energy on VFD use in compressed air systems. Only eight percent of respondents affirmed that the program had conducted a custom evaluation of their air compression systems between 2001 and 2007. Of those end-users for whom evaluations had been carried out, only 12 percent had utilized VFDs to control air compressors prior to the evaluation. On a scale of 1 to 10, where 10 is very important and 1 is not at all important, these same end-users assigned Focus on Energy an average score of 8.0 on the question of significance of the role played by the program in their decision to install VFD controls in compressed air systems.

For the 92 percent of Wisconsin end-users who had not had custom evaluations performed by Focus on Energy, the main reason given was lack of awareness. Other reasons included: cost was prohibitive; compressed air systems were rarely used; not enough time was available; a private company had performed an evaluation; and an evaluation was unnecessary.

In Wisconsin, only eight percent of end-users had facilities in Illinois, while just five percent of Illinois respondents had facilities in Wisconsin. This suggests that a relatively small number of Illinois end-users have been exposed to Focus on Energy. It also suggests that a relatively small number of Wisconsin end-users may be employing energy-efficient technology and practices in other states as a result of participation in the Business Programs.

C. FANS AND PUMPS

With regard to VFDs used with industrial fans and pumps, 67 percent of Wisconsin respondents said that they use fans or blower systems in production equipment on site. Among these respondents, the total horsepower of the motors driving fan and blower systems ranged from 1 to 5,000. The average horsepower was 42 and 24 percent of these motors were controlled by VFDs. By contrast, only 30 percent of Illinois respondents used fans or blowers. Total horsepower of motors driving these systems in Illinois ranged from 1 to 4,000, average horsepower was 129 and 10 percent of motors were controlled by VFDs.

With respect to pumps, in Wisconsin, 50 percent of end-users responded that they use pump systems in on-site production equipment. The total horsepower of motors that drive pump systems ranged from 1 to 9,000, the average horsepower of such motors was 95 and 12 percent of them were controlled by VFDs. In Illinois, 43 percent of end-users replied that they use pump systems. Total horsepower of motors driving these systems ranged from 1 to 7,500, average horsepower was 123 and 21 percent were controlled by VFDs.

Among Wisconsin respondents, 31 percent were aware of Focus on Energy's incentive program for VFDs used to control industrial pumps and fans. Of these respondents, 23 percent received such incentives, and these incentives were used to purchase an average 2.5 VFDs. Although 66 percent of these respondents had used VFDs prior to participating in Focus on Energy, when asked to rate the program on a scale of 1 to 10 where 10 is very important and 1 is not at all important, Wisconsin respondents rated the program an average 8.5.

The surveys asked Wisconsin end-users whether they had participated in energy-efficiency business programs other than Focus on Energy. Among these respondents, 23 percent had participated in other such programs, and 77 percent had not. Those who participated in outside programs took part in a wide range of programs, including ones sponsored by Alliant Energy, Orion Electric, We Energies, Wisconsin Public Service, and the Department of

Energy. They also received a broad array of services, including energy audits, equipment upgrades, incentives, information, and training. Asked to rate the influence of these various programs on VFD installation decision, using a scale of 1 to 10 where 1 is not at all important and 10 is very importance, participants in these other programs assigned them a score of 5.8. This was 2.7 points lower than the overall rating of 8.5 for Focus on Energy.

Twenty-two Wisconsin respondents identified their main activity at the location in question as "Paper and Pulp Industry." Of these end-users, only 19 percent were aware of the program's special study incentives to identify pump system energy efficiency opportunities, available only to paper and pulp firms. The remaining 81 percent were unaware. Of those that were familiar with the special incentives, none had actually taken advantage of this opportunity.

4. REVIEW OF SUPPY-SIDE EFFECTS

This section examines potential indirect program impacts for the Lighting, BP HVAC, and Rotary Channels. It begins with a brief consideration of supply-side effects and their significance in the context of net-to-gross (NTG) adjustments. This is followed by summaries of the supply-side effects results reported in the "Detailed Findings" subsections for each channel and evaluation team conclusions.

4.1 OVERVIEW

The transition to net savings goals from gross savings goals has increased the level of attention on net-to-gross adjustments. The PSC, the evaluation team and the program administrators continue to be motivated to provide a complete assessment of program accomplishments. Evaluation savings adjustments for effects of the program that are not tracked by the program must be considered along with adjustments for measures that would have been implemented without the program. To this end, KEMA added a secondary goal of the *Channel Studies* that was not included in the detailed evaluation plan. This goal is to assess the qualitative evidence to date that there are sizable additional program effects on the market that are not already being captured by the program tracking and current evaluation activities. The present study was intended to gather and assess preliminary data on indirect program effects, as a prelude to possible future elaboration of formal indicators. The purpose of this secondary effort is not to quantify potential program effects in terms of energy savings.

The Focus on Energy Evaluation Team recently produced a white paper titled, *Integrating Supply-Side Results with End-User Net-to-Gross Self Reports*[13]. This white paper lays out a decision matrix to assist evaluators, policymakers and program administrators in weighing the decision to pursue additional supply–side research for incorporation into end-user self-report based NTG analysis. As stated in the white paper, the decision whether to conduct additional research and develop indicators of supply-side effects should be guided by three key criteria:

1. The existence of a plausible, credible, and specific program theory predicting supply-side program effects, or some other sound logical or empirical basis for believing they are likely to exist.

2. Likelihood that predicted effects can be meaningfully assessed through empirical research.

3. Likelihood that the needed research can be performed at reasonable cost, relative to the available budget and likely impact.

The secondary goal of the *Channel Studies* focuses on the first of these three criteria. If this criterion is met, the evaluation team recommends a dialogue with the PSC and the program implementer to assess the second and third criteria. KEMA does not intend to repeat the qualitative assessment nor use the follow-up *Channel Studies* surveys in three years for development of formal indicators. If all three criteria are met KEMA recommends the development of additional supply-side research with the principal objective of quantitatively

[13] Ralph Prahl et al., *Focus on Energy Evaluation: Integrating Supply-Side Results With End-User Net-to-Gross Self-Reports,* Focus on Energy Evaluation, July 2, 2008.

assessing the supply-side effects on the market not already included in the current NTG calculation.

4.1.1 Methodology

In conducting research into indirect impacts, the appropriate first step is to probe the existence and character of any indirect effects occurring in the marketplace, as a prelude to further investigation. In addition to collecting the data for the *Channel Studies*' primary objective, establishment of contract metric baselines for Wisconsin and Illinois, the *Channel Studies*' surveys posed questions to market actors in all three channels that attempt to determine the extent to which the program is having an untracked effect on the market. The results of these survey questions were reported following the metric baselines for each channel in the subsections titled "Detailed Findings"[14]. In this section, we provide a summary of these results and an overall assessment of the size and extent to which the program has had market effects.

A. SURVEY QUESTIONS

The *Channel Studies* provided an effective vehicle to collect data on the existence of supply-side effects. Direct impacts are energy savings of projects that have been installed with program assistance (e.g., rebates) and are accounted for in the program tracking databases. Indirect impacts are energy savings of projects that have been installed as a result of the program but are not accounted for in the program tracking databases. The program's efforts on the supply-side of the market are a potential source of indirect impacts. Supply-side effects are indirect impacts on vendor behavior attributable to a program. Examples of supply-side effects include changes in vendor stocking and specification practices, changes in vendor business strategies, and changes in vendor promotional practices. Such changes are indirect in that they occur as a result of vendor exposure to the program, but are not regularly tracked by the program. The program focuses its tracking of energy savings on projects that have received financial incentives to implement energy efficiency measures.

As a first step toward taking account of supply-side effects, the surveys contained questions designed to gauge the presence of supply-side effects and the character of any such effects detected. Because this research focused on the supply-side of the market, the lighting and HVAC surveys, targeting contractors and distributors, respectively, were particularly suited to posing queries about supply-side effects. The VFD surveys, targeting industrial end-users, were less useful vehicles for probing supply-side effects, yet still included questions on other forms of spillover.

Wisconsin and Illinois lighting contractors, HVAC distributors, and industrial end-users were asked multiple questions in an attempt to assess the scope and scale of supply-side effects. Among the topics addressed by these questions were:

- Level and type of energy efficiency promotion
- Reasons for promoting energy-efficiency
- Importance of energy efficiency to competitiveness

[14] Subsections 3.1.4, 3.2.4, 3.3.4, for Lighting, BP HVAC, and Rotary, respectively.

- Stock of energy efficient equipment
- Reasons for use of energy efficient technologies
- Sales/purchase of energy efficient technologies
- Awareness of Focus on Energy
- Involvement in Focus on Energy
- Influence of Focus on Energy.

B. ASSESSMENT STRATEGY

It is important to note that the purpose of surveying the channels on the subject of supply-side effects was *not* to develop and finalize new indicators of supply-side effects. Rather, it was to assess the utility of constructing such indicators, by establishing the existence of such effects and their nature and scope. This initial research is a prerequisite of possible formal elaboration of supply-side effects indicators through additional supply-side research to be development under the guidance of the PSC if such research is deemed worthwhile. The survey questions on supply-side effects were intended to address three key issues:

- Assess whether there is qualitative evidence to date of program effects on the supply-side of the market.
- Assess whether those effects are likely to be small, medium, or large in relation to direct program effects on sales of efficient products and services.
- Assess the appropriateness of eventually using indicators based on these estimates of program effects for awarding credit for actual energy savings.

Collecting data for both Wisconsin and Illinois provided many interesting and insightful comparisons. At the time this research was conducted, the Focus on Energy Business Programs had no program counterpart in Illinois. Evidence of supply-side effects in Wisconsin but not in Illinois would lead to the inference that the program has exercised significant indirect influence on Wisconsin's energy efficient equipment market. Evidence of supply-side effects in both states would cast doubt on the proposition that the program has meaningful indirect impacts. Evidence of supply-side effects in Illinois alone would call into question the effectiveness of the program overall.

4.1.2 Challenges

There are many challenges associated with the research of supply-side effects. This report provides evidence that the program has had an effect on the market. However, it is important to recognize a few key challenges to this type of research that should be considered.

- It is difficult to disentangle the direct impacts tracked by the program and the non-tracked indirect impacts. This is particularly challenging with a well-established program, such as Focus on Energy that has been offering rebates for many years.
- Is the market effect permanent or it is a temporary market effect that will stop once the program ceases to promote the technology. Has the market been transformed such that customer demand will drive the level of efficiency available in the marketplace?

- Comparing markets and states is inherent with confounding effects. Is it reasonable to think the only difference between Wisconsin and Illinois is the existence of Focus on Energy? What fraction of the market effect is attributable to other energy efficiency programs or utility programs that pre-dated Focus on Energy?
- Are the samples truly similar? Small sample sizes could result in meaningful differences across states based on the responses of a few large respondents. Also, different mixes of business types across states may create market demands dissimilar enough to affect the results.
- It is possible the Wisconsin and Illinois samples sample suffer from self-selection bias. Wisconsin results might be heavily influenced by Focus participants that have benefited from the program, hope to continue to in the future, and have accepted energy efficiency as an important business strategy. Illinois respondents might tend to be early adopters that have already accepted energy efficiency as an important business strategy, important enough to participate in this research effort.

4.2 SUMMARY AND CONCLUSIONS

The results of the *Channel Studies* demonstrate that for each Channel the program has had an effect on the market for the technologies under consideration. KEMA's assessment of the size of this effect and the appropriateness of future research to quantify this effect is provided for each Channel based on the aforementioned "Detailed Finding" results.

4.2.1 Lighting Channel

In Section 3.1.1, KEMA reported that the market share of high-bay fluorescent lighting systems and occupancy controls are higher in Wisconsin relative to Illinois. It is reasonable to infer that Focus on Energy contributed to the higher market shares in Wisconsin. The following results generally support the notion that Focus has affected the market for energy efficient lighting in Wisconsin.

- Wisconsin contractors representing 47 percent of projects completed responded that their promotion of energy-efficient lighting had increased over the previous two years. Contractors representing 53 percent of projects completed reported that their promotional levels had not changed. No Wisconsin lighting contractors reduced their promotional efforts.
- The most important reason Wisconsin contractors promoted energy efficient lighting was "customer satisfaction/retention"; the most important reason cited by Illinois contractors was "increase revenue or margin." Only five percent of Wisconsin contractors cited "increase revenue or margin." Firms in both states mentioned, energy savings, cost savings, and environmental concerns as reasons to promote energy-efficient lighting technology.
  - These results suggest a substantial increase in energy-efficiency promotional efforts by Wisconsin contractors, driven in large measure by a perceived need to ensure customer satisfaction. In other words, Wisconsin vendors appear to have altered their promotional practices in response to consumer demand. This demand is less pronounced in Illinois, and vendors there have not changed their levels of high-efficiency equipment promotion. With no parallel program in Illinois, it is reasonable to infer that Focus on Energy contributed to changes in customer

preferences, and thus is indirectly responsible for consequent changes in vendor behavior.

- Illinois lighting contractors representing 77 percent of projects attributed customer refusals to the view that "cost is too high." In Wisconsin, where recommendations are accepted much more often, firms representing only 32 percent of projects cited customer cost concerns.
  - The fact that cost is a minimal factor in Wisconsin is likely attributable to the program, due either to program rebates, greater awareness of the cost savings associated with efficiency caused by exposure to the program, or some combination of the two.
- Wisconsin contractors representing 97 percent of projects were aware of the Business Programs.
- Wisconsin contractors responsible for 95 percent of projects had participated in projects that received program incentives.
  - Potential self-selection bias. Is it reasonable to believe that contractors representing 95 percent of projects in Wisconsin have participated in projects that received Focus rebates?
- On a scale of 1 to 10, where 1 is not at all important and 10 is very important, Wisconsin contractors assigned Focus on Energy a score of 5.7 on the question of program influence on decisions to increase promotion of energy-efficient equipment.
- On a scale of 1 to 10, where 1 is no influence and 10 is a great deal of influence, these contractors assigned the program a score of 6.3 on the question of program influence on the market share of efficient lighting technologies.
- Wisconsin firms responsible for 68 percent of projects said that the share of projects in which they installed high-bay fluorescent fixtures would have "stayed about the same" in the absence of Focus on Energy.
- Results indicate that Wisconsin consumers take greater account of multiple lighting equipment characteristics when selecting technology to purchase than do Illinois consumers.
  - Wisconsin contractors rated operating costs (7.8), quality of light (7.8), upfront costs (7.7), and total life cycle costs (7.1) as the most important characteristics, followed by ease of maintenance (6.2) and maintenance of lighting level (6.0).
  - Ratings by Illinois contractors were lower, with initial cost (7.3) and quality of light (6.6) ranked highest. Operating costs (6.1), total life cycle costs (6.0), maintenance of lighting level (5.9), and ease of maintenance (5.9) were regarded as less important to customer selection decisions by Illinois firms.

High awareness and participation levels provide a direct link between the differences in the energy efficient lighting markets of Wisconsin and Illinois and the Focus on Energy Program. However, Wisconsin lighting contractors tended to discount the influence of Focus on Energy on the state's lighting market. The ratings given to Focus for program influence on decisions to increase promotion of energy-efficient equipment and program influence on the market share of efficient lighting technologies are low relative to scores provided by the HVAC distributors for a similar sequence of questions. A large majority of Wisconsin contractors also

claim the share of projects in which they installed high-bay fluorescent fixtures would have "stayed about the same" in the absence of Focus on Energy. One possibility for this disconnect may be that the Business Programs have helped to transform the market to such an extent that their importance has become obscured.

The Lighting Channel surveys provide potentially strong evidence of supply-side effects. However if contractors are still using the rebates to realize their energy efficiency sales then these are direct impacts because the energy savings are being tracked by the program. Using the number of projects completed in the past 12 months that received rebates as a proxy for in-program sales (direct impacts) we estimated that 65 percent of projects are out-of-program sales (indirect impacts). If we believe the vendor estimates then a large fraction of energy efficiency sales are out-of-program sales and potentially attributable to the program.

It has been established that strong empirical evidence of supply-side effects exists in the lighting channel. With respect to the question of productiveness, the core issue is the extent to which indicators of supply-side effects could be devised that would demonstrate indirect program impacts distinct from other market influences and impacts already tracked by the program. The evidence presented above derived from a comparison of lighting market dynamics in Wisconsin and Illinois, based on the rationale that the markets in these two states were roughly identical save for Focus on Energy in Wisconsin. With other market variables effectively "controlled for," it was shown that supply-side effects of notable magnitude were present in Wisconsin, and hence were likely caused by Focus on Energy. We also concluded base on the survey responses that a large fraction of energy efficiency sales are likely to be untracked. In other words, this preliminary research was conducted in such a way as to demonstrate that meaningful indirect effects *can be* isolated from other market factors. KEMA concludes that indirect supply-side effects are likely to exist and recommends the PSC consider additional supply-side research.

4.2.2 HVAC Channel

In Section 3.2.1, KEMA reported that the market share of energy-efficient HVAC units smaller than 65 MBh/5.4 tons, as well as CO_2 sensors and demand control ventilation systems, are higher in Wisconsin relative to Illinois. It is reasonable to infer that Focus on Energy contributed to the higher market shares in Wisconsin. Although the following summary of detailed finding results highlights some unexpected Wisconsin and Illinois comparison results the Wisconsin distributor results support the existence of supply-side effects.

- Firms were asked to rate the importance of energy-efficient equipment sales to maintaining their competitive position, using a 10-point scale where 1 is not at all important and 10 is very important. Wisconsin distributors assigned energy efficiency a score of 9.1, while Illinois distributors rated it 7.5.
  - This suggests that Wisconsin firms have privileged energy efficiency in their business calculations to a greater extent than their Illinois counterparts, which in turn suggests that the program has indirectly influenced distributors by intensifying consumer demand for high-efficiency HVAC equipment.
- Surprisingly, Wisconsin and Illinois respondents reported similar levels of high-efficiency equipment promotion. Specifically, Wisconsin distributors representing 96 percent of units sold said that they had promoted energy-efficient packaged HVAC units to contractors in the past two years; compared to Illinois distributors representing 98 percent of sales.

  - Although promotion rates in these two states were comparable, higher rates in Illinois would not necessarily have been surprising. It is likely that most distributors in Wisconsin have been working with Focus on Energy for more than two years. If this is the case, then these distributors probably would have intensified their promotion of energy-efficient lighting several years ago, well before more recent advances in neighboring Illinois. Stable promotional levels in Wisconsin may well be higher than growing levels in Illinois.

- Even more surprising, for every size category, a higher percentage of sales in Illinois was generated by firms with energy-efficient HVAC units in stock than was the case in Wisconsin.
- Wisconsin sales were significantly larger than Illinois sales, for every size category.
  - This is the effect of two very large firms in Wisconsin firms; no Illinois firms of similar magnitude completed the survey.
- Wisconsin distributors representing 99 percent of sales claimed to be aware of the Business Programs. Of these distributors, firms representing 97 percent of units sold had supplied HVAC equipment to projects that received program incentives.
- Wisconsin firms representing 95 percent of sales replied that the share of high-efficiency packaged HVAC units they sold had increased over the past two years, by an average of 31 percent. The comparable figures for Illinois firms were 75 percent and 31 percent, respectively.
- Wisconsin distributors representing 92 percent of units sold said that the market share of energy-efficient RTUs would have been lower in the absence of Focus on Energy.
- On a scale of 1 to 10, where 1 is no influence and 10 is a great deal of influence, Wisconsin distributors assigned the program an average score of 8.0 for overall influence of Focus on Energy on the market share of energy-efficient HVAC units.
- Although the results were not statistically significant Wisconsin distributors estimate the typical cost difference between efficient units and standard units to be greater than did their Illinois counterparts.
  - For the smallest size category, the cost difference in Wisconsin was $167.39 greater than the cost difference in Illinois, for the second smallest category, the differential was $177.60, and for the second largest category, the cost differential was $316.70.[15]

In Section 3.3, the presence of direct program effects in the HVAC channel was demonstrated. Specifically, evidence exists that Focus on Energy has contributed to increased sales of energy-efficient HVAC units in the smallest size category, less than 65 MBh/5.4 tons. Furthermore, there is strong evidence that the program has helped encourage sales of rooftop units fitted with CO_2 sensors and demand control ventilation systems. This is potentially a significant indirect impact because the Focus Program does not offer a prescriptive incentive for CO_2 sensors and demand control ventilation, KEMA has not seem

[15] These results will be further investigated in the Incremental Costs Study currently being conducted jointly by the Focus Evaluation Team and the program implementer.

many custom incentives for this improvement in its impact evaluation fieldwork, and the savings for such improvements to systems is not included in the current deemed savings calculation for rooftop units.

The inconsistent and unexpected stocking and pricing results are likely due to challenges of sampling from a small population. Another possibility is that the energy efficient HVAC market at the distributor level is immature. The program has only recently begun to market upstream to distributors and also has made a significant increase in the amount of the rebates offered to end-use customers. Perhaps these results of distributor interviews will be more along the lines of expectations if this market is given more time to mature.

Despite the unexpected stocking and pricing results, the HVAC Channel survey results do support the possibility that the program is having an effect on the market. Wisconsin distributors overwhelmingly agreed that energy-efficient equipment sales are important to maintaining their competitive position and that the program has played an important role in the market share of energy efficient units sold. Furthermore, Wisconsin distributors reported increased promotion of high efficiency units and increased sales in the past two years. However if distributors are still using the rebates to realize their energy efficiency sales then these are direct impact because the energy savings are being tracked by the program. Similar to the calculation used for the Lighting Channel, KEMA estimated out-of-program sales as the fraction of projects completed in the past 12 months that did not receive rebates. We estimate that 70 percent of projects are out-of-program sales. If we believe the vendor estimates then a large fraction of energy efficiency sales are out-of-program sales and potentially attributable to the program. In summary, these results support the existence of market effects and therefore KEMA advises the PSC to pursue supplemental supply-side research.

4.2.3 Rotary Channel

In Section 3.3.1, KEMA reported the Wisconsin and Illinois baseline estimates for compressed air, fans and blowers, and pumps. The baselines for VFDs used in compressed air, and fan and blower systems in Wisconsin and Illinois are similar. In the case of pumps the results were similar when the results were considered in total, but when broken down by size categories the Illinois baselines were higher for the smaller pumps categories while the Wisconsin baselines were higher for the larger pump categories. Saturation level baselines exhibited greater variation, with Wisconsin large motor VFD saturation levels significantly higher than those for Illinois. Overall, the evidence of sizable market effects on the VFD market is not as compelling as the evidence for the Lighting and HVAC markets, but it does meet the white paper's criteria in support for further research.

Because the VFD surveys engaged industrial end-users, no data were gathered from the supply-side of the VFD market. However, a number of questions were included in the surveys that probed for nonparticipant spillover effects in the rotary channel. While the responses to these questions did not address supply-side effects, they were useful to the extent that they shed light on the indirect influence of the Business Programs on the broader market.

What follows are major findings regarding nonparticipant spillover effects in the rotary channel:

- Among Wisconsin VFD end-users, 21 percent claimed to take advantage of all available opportunities to benefit from VFDs and 14 percent claimed to take

advantage of most opportunities, while 48 percent responded that they had taken advantage of none of these opportunities.

  - For those who had taken advantage of all or most opportunities, 59 percent cited "energy savings" as the most important reason to use VFDs, followed by "increased productivity" at 18 percent. For Wisconsin end-users who did not take advantage of all or most opportunities, 55 percent cited "cost was too high" as the primary reason, followed by 18 percent who said they were "not aware of VFDs."

- Among Illinois end-users, nine percent took advantage of all opportunities to benefit from VFDs and 15 percent took advantage of most opportunities. In contrast, 61 percent replied that they took advantage of no opportunities.
  - Among Illinois respondents who took advantage of all or most opportunities, "energy savings" was named as the most important reason to do so by 36 percent of end-users, followed by "increased productivity" at 31 percent. For respondents who did not take advantage of opportunities at high levels, 47 percent attributed this to the fact that they were "not aware of VFDs," while 27 percent cited "not enough motor operating hours to justify investment."

These results appear to indicate a moderately greater tendency for Wisconsin end-users to take advantage of opportunities to benefit from VFDs than for Illinois end-users to do so. Results also show Illinois respondents are more liable to waste such opportunities, by a 17-percentage-point difference. Furthermore, the most common explanation for why Illinois end-users failed to exploit these opportunities, a lack of awareness, was cited much less frequently by similarly situated Wisconsin end-users, accounting for just 17 percent of responses. It is likely that the Business Programs are at least in part responsible for the greater familiarity with VFDs exhibited by Wisconsin consumers, as well as their greater willingness to embrace the technology.

- Wisconsin end-users purchased an average 4.0 AC electric motors between 1 and 200 hp over the previous year, and 29 percent of these motors were rated NEMA Premium Efficiency. Illinois end-users bought an average 9.8 AC motors in this horsepower range, and 32 percent were rated NEMA Premium Efficiency.
  - Among end-users who either had not purchased AC motors in this horsepower range, or had purchased AC motors in this horsepower range but were unsure whether the unit purchased was rated as NEMA Premium Efficiency, only 15 percent of Wisconsin respondents had heard of NEMA Premium Efficiency motors, while just 9 percent of Illinois respondents were so informed.

- Only eight percent of Wisconsin respondents affirmed that the program had conducted a custom evaluation of their air compression systems between 2001 and 2007.
  - Of those end-users for whom evaluations had been carried out, only 12 percent had utilized VFDs to control air compressors prior to the evaluation.
  - On a scale of 1 to 10, where 10 is very important and 1 is not at all important, these same end-users assigned Focus on Energy an average score of 8 on the question of significance of the role played by the program in their decision to install VFD controls in compressed air systems.
  - For the 92 percent of Wisconsin end-users who had not had custom evaluations performed by Focus on Energy, the main reason given was lack of awareness.

Other reasons included: cost was prohibitive; compressed air systems were rarely used; not enough time was available; a private company had performed an evaluation; and an evaluation was unnecessary. These data suggest that a high level of general awareness of the program does not extend to its custom evaluation component. But for those who do take part, there is a high level of satisfaction and recognition of the important role played by Focus on Energy.

- Thirty-one percent of Wisconsin respondents were aware of Focus on Energy's incentive program for VFDs used to control industrial pumps and fans.
  - Of these respondents, 23 percent received such incentives, and these incentives were used to purchase an average 2.5 VFDs.
  - Although 66 percent of these respondents had used VFDs prior to participating in Focus on Energy, when asked to rate the program on a scale of 1 to 10 where 10 is very important and 1 is not at all important, Wisconsin respondents rated the program an average 8.5. These results mirror those for compressed air evaluations, insofar as they demonstrate relatively low participation but considerable appreciation for the program among those who receive benefits.

Taken as a whole, these findings reveal limited nonparticipant spillover effects in the Rotary Channel. Wisconsin end-users take advantage of VFD opportunities at slightly higher rates and appear to be better informed about VFD technology than are their Illinois peers. However, despite the enthusiasm of participants, relatively few Wisconsin respondents have actually taken part in specific program measures. Although these spillover effects are observable, they do not appear to be widespread. In summary, the *Channel Studies* provide enough evidence to pass the white paper's criteria in support for further research. We do recommend additional supply-side research for the VFD market, but less strongly than we do for Lighting and HVAC markets. However, we do recommend the program continue to expand its efforts in the Rotary Channel with respect to VFDs.

WISCONSIN FOCUS ON ENERGY CONTRACT METRICS ASSESSMENT - 2008

WISCONSIN LIGHTING CONTRACTOR SURVEY

INTRODUCTION

Hi my name is _____. I'm calling from Braun Research, an energy research firm. We are conducting research on the commercial and industrial lighting market in your area on behalf of Wisconsin Focus on Energy. I am not selling anything.

May I speak with the person in your company who is most familiar with your firm's lighting installation work?

ENTER NAME OF CONTACT: _____

IF CONTACT IS NOT AVAILABLE, ASCERTAIN BEST TIME TO CALL.

Lead in for respondent.

Hello, this is _____ calling from Braun Research. We are conducting research on the commercial and industrial lighting market in your area on behalf of Wisconsin Focus on Energy. All information you provide will be confidential and will not be linked in any way to you or your company. These questions will take about 15 minutes. In appreciation for completion of the interview, you will be entered into a drawing for a $1,000 prize.

SCREENING

1.1 Does your company conduct any of the following business activities?…[ACCEPT MULTIPLES]

Manufacture commercial or industrial lighting equipment.....1

Design or layout commercial or industrial lighting 2

Install commercial or industrial lighting equipment 3

Sell commercial or industrial lighting equipment 4

IF 1.1 = 3 THEN CONTINUE, ELSE THANK AND END SURVEY

1.2 Does your company complete at least $50,000 per year in commercial and industrial lighting installations?

Yes.....1

No 2

Don't Know.....9

IF 1.2 = 1, THEN PROCEED. ELSE THANK AND END SURVEY.

CLASSIFICATION/FIRMOGRAPHICS

2.1 Which of the following best describes your firm? ACCEPT ONE.

Electrical contractor 1

Lighting contractor 2

Lighting maintenance company 3

Other: _____ 97

2.2 What is your title or position in the firm?

Proprietor/CEO 1

Director of Sales 2

Engineer 3

Designer 4

Manager 5

Project Manager 7

Other (_____) 97

Don't know 98

Refused 99

2.3 How many locations does your firm have in Wisconsin?

ENTER NUMBER, 998 FOR DK, 999 FOR REF ..... _____

2.4 How many full-time equivalent workers of all types do you employ at this location?

ENTER NUMBER OF FTEs, 998 FOR DK, 999 FOR REF ..... _____

2.5 Roughly how many commercial and industrial lighting installation projects did your firm work on in the last 12 months in Wisconsin?

ENTER NUMBER, 9998 FOR DK, 9999 FOR REF ..... _____

2.6 Approximately what percentage of your commercial and industrial lighting revenues are contributed by… ENTER PERCENT, 998 FOR DK, 999 FOR REF.

a. New construction ..... _____%

b. Major renovation and remodeling..... _____%

c. Replacement of failed equipment..... _____%

d. Retrofit of functioning equipment ..... _____%

.....100 %

2.7 In rough terms, what percentage of your commercial and industrial lighting work is done on [READ SELECTIONS a – h] projects? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

a. Office..... _____%

b. Retail ..... _____%

c. Grocery Store ..... _____%

d. Healthcare ..... _____%

e. Hospitality..... _____%

f. Schools and government ..... _____%

g. Other commercial ..... _____%

h. Industrial..... _____%

.....100 %

2.8 Do you perform commercial or industrial lighting work in Illinois?

Yes.....1

No 2

Don't Know.....9

IF 2.8 = 1 ASK 2.9, ELSE SKIP TO 3.1.

2.9 Roughly how many commercial and industrial lighting installation projects did your firm work on in the last 12 months in Illinois?

ENTER NUMBER, 9998 FOR DK, 9999 FOR REF ..... _____

SPECIFICATION

Now I'd like to ask some questions about lighting equipment specification.

3.1 FOR EACH SALES CATEGORY (NEW CONSTRUCTION, REMODELING): Roughly speaking, for what percent of your [NEW CONSTRUCTION, REMODELING,] projects does your company specify the equipment to be installed, as opposed to an architect or engineer at another firm? ENTER PERCENT. 998 FOR DK, 999 FOR REFUSED

a. New Construction	b. Remodeling

3.2 On a scale from 1 to 10 where 1 is not at all important and 10 is very important, How important do your commercial customers treat the following lighting equipment characteristics when making equipment selection decisions: ENTER NUMBER 1 – 10, 98 FOR DK, 99 FOR REF.

a. Initial cost of the equipment ..... _____

b. Costs of operation ..... _____

c. Total life cycle costs ..... _____

c. Quality of light ..... _____

d. Maintenance of lighting level ..... _____

e. Ease of maintenance ..... _____

INSTALLATION

Now I'd like to ask you a few questions about your recent experience with specification and installation of specific kinds of equipment. ASK 4.1 AND 4.2 FOR EACH TECHNOLOGY.

4.1 In what percentage of the commercial and industrial lighting projects you completed in the last 12 months did you recommend or specify [READ TECHNOLOGY FROM ANSWER GRID]? Your best estimate is fine. ENTER PERCENT, 998 FOR DK, 999 FOR REF.

4.2 In what percentage of those projects did you actually install [READ TECHNOLOGY FROM ANSWER GRID]? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

Technology	**4.1**	**4.2**
a. High Performance T-8 Systems as defined by CEE		
b. T-5 Lighting technology (IF NECESSARY SAY, "includes T5 and T5 High Output")		
c. Occupancy controls		
d. Automatic daylighting controls		

4.3 In what percent of the commercial and industrial lighting projects you completed in the past 12 months did you install high-bay lighting equipment of any type? [If necessary

say, "High-bay lighting is defined as lighting installed greater than 20 feet off the floor. Common high-bay installations are warehouses, industrial facilities, and gymnasiums."]

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

4.4 In what percent of the projects in which you installed high-bay lighting did you recommend installation of fluorescent as opposed to HID fixtures?

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

4.5 In what percent of the projects in which you installed high-bay lighting did you actually install fluorescent as opposed to HID fixtures?

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

FOR ALL ITEMS 4.2 a – c: IF 4.1 > 4.2 OR IF 4.4 > 4.5, ASK 4.6.a.

ELSE IF 4.1=0 AND 4.4=0, ASK 4.6.c. [these are contractors that do not recommend ee lighting]

ELSE SKIP TO 4.7.

4.6.a What do you think is the main reason why customers do not follow your recommendations in regard to installing energy efficient lighting? ACCEPT ONE ONLY.

4.6.b Are there other important reasons? ACCEPT MULTIPLES.

		4.6.a	4.6.b
1	Cost is too high		
2	Appearance of equipment		
3	Quality of light		
4	Difficulty in maintenance		
5	Lack of information about performance		
6	Difficulty of installation		
7	Requires rewiring, remodeling, or other ancillary work		
97	Other (Specify) _____		
98	Don't know		
99	Refused		

IF ASKED 4.6.a AND 4.6.b THEN SKIP TO 4.7.

4.6.c What is the main reason you do not recommend installing energy efficient lighting? ACCEPT ONE ONLY.

4.6.d Are there other important reasons? ACCEPT MULTIPLES.

		4.6.a	4.6.b
1	Cost is too high		
2	Appearance of equipment		
3	Quality of light		
4	Difficulty in maintenance		
5	Lack of information about performance		
6	Difficulty of installation		
7	Requires rewiring, remodeling, or other ancillary work		
97	Other (Specify) _____		
98	Don't know		
99	Refused		

4.7 Over the past 2 years, would you say that your firm's efforts to promote energy-efficient lighting products to commercial and industrial customers have increased, decreased, or stayed about the same?

Increased 1

Decreased.....2

Stayed about the same.....3

Don't know.....8

Refused.....9

IF 4.7 = 1, ASK 4.7.a. ELSE SKIP TO 4.8.a.

4.7.a What specific promotional efforts did your firm undertake in support of energy-efficient lighting fixtures?

ENTER VERBATIM. _____

4.8.a What do you think is the most important reason for a firm such as yours to promote energy efficient lighting equipment? DO NOT READ. ACCEPT ONE ONLY.

4.8.b Are there other reasons? DO NOT READ. ACCEPT MULTIPLES.

Respondent	4.7a	4.7b
1. Competitors are doing it		
2. Increased revenue or margin		
3. Customer satisfaction/retention		
4. Efficient equipment is more durable, fewer call backs		
5. Other (Specify)		

4.9 Using a scale of 1 to 10, where 1 is 'not at all important' and 10 is 'very important': How important is the offer of energy efficient equipment in maintaining your firm's competitive position?

ENTER SCORE 1 – 5, 98 FOR DK ..... _____

RESPONSE TO PROGRAM

5.1 Are you aware of the Wisconsin Focus on Energy programs for businesses?

Yes.....1

No 2

Don't know.....3

IF 5.1 = 1, ASK 5.1.a. ELSE SKIP TO 5.4.a

5.1.a Have you participated in projects that have received incentives from Focus on Energy?

Yes.....1

No 2

Don't know.....3

IF 5.1.a = 1, ASK 5.1.b. ELSE SKIP TO 5.2.

5.1.b Roughly how many such projects did you participate in during the last 12 months?

ENTER NUMBER OF PROJECTS, CODE 998 FOR DK, 999 FOR REF ____

5.2 Have you participated in any training programs sponsored or co-sponsored by Wisconsin Focus on Energy?

Yes.....1

No 2

Don't know.....3

IF 5.2 = 1, ASK 5.2.a. ELSE SKIP TO 5.3.

5.2.a In which program did you participate?

ENTER VERBATIM_____

5.3 On a scale of 1 to 10, where 1 is not at all important and 10 is very important, how important were the Focus on Energy programs in your firm's decision to increase promotion of energy-efficient lighting equipment?

ENTER 1 – 10, 98 FOR DK, 99 FOR REFUSED ....._____

5.4.a Have you participated in programs other than Focus on Energy that promote energy efficient technologies for businesses?

Yes.....1

No 2

Don't know.....3

IF 5.4.a = 1, ASK 5.4.b. ELSE SKIP TO 5.5.

5.4.b In which program did you participate?

ENTER VERBATIM_____

5.4.c Please describe the services you received?

ENTER VERBATIM_____

5.4.d On a scale of 1 to 10, where 1 is not at all important and 10 is very important, how important were these programs in your firm's decision to increase promotion of energy-efficient lighting equipment?

ENTER 1 – 10, 98 FOR DK, 99 FOR REFUSED ....._____

ASK 5.5 – 5.7 IN SEQUENCE FOR EACH TECHNOLOGY a – e IN THE ANSWER GRID BELOW.

5.5 Over the past two years, has the percentage of commercial and industrial projects in which you install [TECHNOLOGY a – d] increased, decreased, or stayed about the same? .....

Increased 1

Decreased.....2

Stayed about the same.....3

Don't know.....8

Refused.....9

IF 5.5 [a-e] = 1, ASK 5.6 [a – e] and 5.7 [a – e] ELSE SKIP TO 5.8.

5.6 Using the year 2005 as a base, by what percent did the percentage of projects in which you install [NAME OF TECHNOLOGY a – e] increase? Your best estimate is fine.

5.7 If Focus on Energy had not operated its programs, do you think the share projects in which you install [NAME OF TECHNOLOGY a – e] would be lower, higher, or about the same as it actually is now?

Lower 1

Higher.....2

Stayed about the same.....3

Don't know.....8

Refused.....9

Technology	**5.5**	**5.6**	**5.7**
a. High Performance T-8 Systems as defined by CEE			
b. T-5 Lighting technology (IF NECESSARY SAY, "includes T5 and T5 High Output")			
c. Occupancy controls			
d. Automatic daylighting controls			
e. High bay fluorescent fixtures			

5.8 Finally, on a scale of 1 to 10, where 1 is no influence and 10 is a great deal of

influence, how much influence do you think Focus on Energy programs have had on the market share of energy-efficient lighting technologies in your market area?

ENTER 1 – 10, 98 FOR DK, 99 FOR REFUSED ....._____

Record Contact Information for Drawing:

Name: _____

Address: _____

Phone: _____

Email: _____

THANK YOU FOR YOUR TIME AND COOPERATION.

WISCONSIN FOCUS ON ENERGY CONTRACT METRICS ASSESSMENT - 2008

ILLINOIS LIGHTING CONTRACTOR SURVEY

INTRODUCTION

Hi my name is _____. I'm calling from Braun Research, an energy research firm. We are conducting research on the commercial and industrial lighting market in your area in support of energy efficiency programs provided by various organizations in the Midwest. I am not selling anything.

May I speak with the person in your company who is most familiar with your firm's lighting installation work?

ENTER NAME OF CONTACT: _____

IF CONTACT IS NOT AVAILABLE, ASCERTAIN BEST TIME TO CALL.

Lead in for respondent.

Hello, this is _____ calling from Braun Research. We are conducting research on the commercial and industrial lighting market in your area in support of energy efficiency programs provided by various organizations in the Midwest. All information you provide will be confidential and will not be linked in any way to you or your company. These questions will take about 15 minutes. In appreciation for completion of the interview, you will be entered into a drawing for a $1,000 prize.

SCREENING

1.1 Does your company conduct any of the following business activities? [ACCEPT MULTIPLES]

Manufacture commercial or industrial lighting equipment.....1

Design or layout commercial or industrial lighting 2

Install commercial or industrial lighting equipment.....3

Sell commercial or industrial lighting equipment 4

IF 1.1 = 3 THEN CONTINUE, ELSE THANK AND END SURVEY.

1.2 Does your company complete at least $50,000 per year in commercial and industrial lighting installations?

Yes.....1

No 2

Don't Know 9

IF 1.2 = 1 THEN PROCEED, ELSE THANK AND END SURVEY.

CLASSIFICATION/FIRMOGRAPHICS

2.1 Which of the following best describes your firm? ACCEPT ONE.

Electrical contractor 1

Lighting contractor 2

Lighting maintenance company 3

Other: _____.....97

2.2 What is your title or position in the firm?

Proprietor/CEO 1

Director of Sales 2

Engineer 3

Designer 4

Manager 5

Project Manager 7

Other (_____) 97

Don't know.....98

Refused.....99

2.3 How many locations does your firm have in Illinois?

ENTER NUMBER, 998 FOR DK, 999 FOR REF ....._____

2.4 How many full-time equivalent workers of all types do you employ at this location?

ENTER NUMBER OF FTEs, 998 FOR DK, 999 FOR REF ....._____

2.5 Roughly how many commercial and industrial lighting installation projects did your firm work on in the last 12 months in Illinois?

ENTER NUMBER, 9998 FOR DK, 9999 FOR REF ....._____

2.6 Approximately, what percentage of your commercial and industrial lighting revenues are contributed by… ENTER PERCENT, 998 FOR DK, 999 FOR REF.

a. New construction ....._____%

b. Major renovation and remodeling....._____%

c. Replacement of failed equipment....._____%

d. Retrofit of functioning equipment ....._____%

.....100 %

2.7 In rough terms, what percentage of your commercial and industrial lighting work is done on [READ SELECTIONS a – h] projects? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

a. Office....._____%

b. Retail ....._____%

c. Grocery Store ....._____%

d. Healthcare……._____%

e. Hospitality…….._____%

f. Schools and government…… ._____%

g. Other commercial……._____%

h. Industrial....._____%

.....100 %

2.8 Do you perform commercial or industrial lighting work in Wisconsin?

Yes.....1

No 2

Don't Know.....9

IF 2.8 = 1 ASK 2.9, ELSE SKIP TO 3.1.

2.9 Roughly how many commercial and industrial lighting installation projects did your firm work on in the last 12 months in Wisconsin?

ENTER NUMBER, 9998 FOR DK, 9999 FOR REF ....._____

SPECIFICATION

Now I'd like to ask some questions about lighting equipment specification.

3.1 FOR EACH SALES CATEGORY (NEW CONSTRUCTION, REMODELING): Roughly speaking, for what percent of your [NEW CONSTRUCTION, REMODELING,] projects does **your company** specify the equipment to be installed, as opposed to an architect or engineer at another firm? ENTER PERCENT. 998 FOR DK, 999 FOR REFUSED.

a. New Construction	b. Remodeling

3.2 On a scale from 1 to 10 where 1 is not at all important and 10 is very important, How important do your commercial customers treat the following lighting equipment characteristics when making equipment selection decisions: ENTER NUMBER 1 – 10, 98 FOR DK, 99 FOR REF.

a. Initial cost of the equipment ..... _____

b. Costs of operation ..... _____

c. Total life cycle costs ..... _____

c. Quality of Light ..... _____

d. Maintenance of lighting level ..... _____

e. Ease of Maintenance ..... _____

INSTALLATION

Now I'd like to ask you a few questions about your recent experience with specification and installation of specific kinds of equipment. ASK 4.1 AND 4.2 FOR EACH TECHNOLOGY.

4.1 In what percentage of the commercial and industrial lighting projects you completed in the last 12 months did you recommend or specify [READ TECHNOLOGY FROM ANSWER GRID]? Your best estimate is fine. ENTER PERCENT, 998 FOR DK, 999 FOR REF.

4.2 In what percentage of those projects did you actually install [READ TECHNOLOGY FROM ANSWER GRID]? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

Technology	4.1	4.2
a. High Performance T-8 Systems as defined by CEE		
b. T-5 Lighting technology (IF NECESSARY SAY, "includes T5 and T5 High Output")		
c. Occupancy controls		
d. Automatic daylighting controls		

4.3 In what percent of the commercial and industrial lighting projects you completed in the past 12 months did you install high-bay lighting equipment of any type? [If necessary say, "High-bay lighting is defined as lighting installed greater than 20 feet off the floor. Common high-bay installations are warehouses, industrial facilities, and gymnasiums."]

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

4.4 In what percent of the projects in which you installed high-bay lighting did you recommend installation of fluorescent as opposed to HID fixtures?

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

4.5 In what percent of the projects in which you installed high-bay lighting did you actually install fluorescent as opposed to HID fixtures?

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

FOR ALL ITEMS 4.2 a – c: IF 4.1 > 4.2 OR IF 4.4 > 4.5, ASK 4.6.a.

ELSE IF 4.1=0 AND 4.4=0, ASK 4.6.c. [these are contractors that do not recommend ee lighting]

ELSE SKIP TO 4.7.

4.6.a What do you think is the main reason why customers do not follow your recommendations in regard to installing energy efficient lighting? ACCEPT ONE ONLY.

4.6.b Are there other important reasons? ACCEPT MULTIPLES.

		4.6.a	4.6.b
1	Cost is too high		
2	Appearance of equipment		
3	Quality of light		

4	Difficulty in maintenance		
5	Lack of information about performance		
6	Difficulty of installation		
7	Requires rewiring, remodeling, or other ancillary work		
97	Other (Specify) _____		
98	Don't know		
99	Refused		

IF ASKED 4.6.a AND 4.6.b THEN SKIP TO 4.7.

4.6.c What is the main reason you do not recommend installing energy efficient lighting? ACCEPT ONE ONLY.

4.6.d Are there other important reasons? ACCEPT MULTIPLES.

		4.6.a	**4.6.b**
1	Cost is too high		
2	Appearance of equipment		
3	Quality of light		
4	Difficulty in maintenance		
5	Lack of information about performance		
6	Difficulty of installation		
7	Requires rewiring, remodeling, or other ancillary work		
97	Other (Specify) _____		
98	Don't know		
99	Refused		

4.7 Over the past 2 years, would you say that your firm's efforts to promote energy-efficient lighting products to commercial and industrial customers have increased, decreased, or stayed about the same?

Increased 1

Decreased 2

Stayed about the same.....3

Don't know.....8

Refused.....9

IF 4.7 = 1, ASK 4.7.a. ELSE SKIP TO 4.8.a.

4.7.a What specific promotional efforts did your firm undertake in support of energy-efficient lighting fixtures?

ENTER VERBATIM. _____

4.8.a What do you think is the most important reason for a firm such as yours to promote energy efficient lighting equipment? DO NOT READ. ACCEPT ONE ONLY.

4.8.b Are there other reasons? DO NOT READ. ACCEPT MULTIPLES.

Respondent	**4.7a**	**4.7b**
1. Competitors are doing it		
2. Increased revenue or margin		
3. Customer satisfaction/retention		
4. Efficient equipment is more durable, fewer call backs		
5. Other (Specify)		

4.9 Using a scale of 1 to 10, where 1 is 'not at all important' and 10 is 'very important': How important is the offer of energy efficient equipment in maintaining your firm's competitive position?

ENTER SCORE 1 – 5, 98 FOR DK ..... _____

TRENDS IN INSTALLATIONS

5.1.a Have you participated in any government or utility programs that promote energy efficient technologies for businesses?

Yes.....1

No 2

Don't know.....3

IF 5.1.a = 1, ASK 5.1.b. ELSE SKIP TO 5.2.

5.1.b In which program did you participate?

ENTER VERBATIM_____

5.1.c Please describe the services you received?

ENTER VERBATIM_____

5.1.d On a scale of 1 to 10, where 1 is not at all important and 10 is very important, how important were these programs in your firm's decision to increase promotion of energy-efficient lighting equipment?

ENTER 1 – 10, 98 FOR DK, 99 FOR REFUSED ....._____

ASK 5.2 – 5.3 IN SEQUENCE FOR EACH TECHNOLOGY a – e IN THE ANSWER GRID BELOW.

5.2 Over the past two years, has the percentage of commercial and industrial projects in which you install the following lighting technologies increased, decreased, or stayed about the same?

Increased 1

Decreased.....2

Stayed about the same.....3

Don't know.....8

Refused.....9

IF 5.2 [a-e] = 1, ASK 5.3 [a – e], ELSE THANK AND CONCLUDE.

5.3 Using the year 2005 as a base, by what percent did the percentage of projects in which you install [NAME OF TECHNOLOGY a – e] increase? Your best estimate is fine.

Technology	**5.2**	**5.3**
a. High Performance T-8 Systems as defined by CEE		
b. T-5 Lighting technology (IF NECESSARY SAY, "includes T5 and T5 High Output")		
c. Occupancy controls		
d. Automatic daylighting controls		
e. High bay fluorescent fixtures		

Record Contact Information for Drawing:

Name: _____

Address: _____

Phone: _____

Email: _____

THANK YOU FOR YOUR TIME AND COOPERATION.

WISCONSIN FOCUS ON ENERGY CONTRACT METRICS ASSESSMENT - 2008
WISCONSIN HVAC DISTRIBUTOR SURVEY

INTRODUCTION

Hi my name is _____. I'm calling from Braun Research, an energy research firm. We are conducting research on the market for packaged commercial HVAC units in your area on behalf of Wisconsin Focus on Energy. We are not selling anything.

May I speak with the person in your company who is most familiar with your firm's sales of commercial HVAC equipment?

ENTER NAME OF CONTACT: _____

IF CONTACT IS NOT AVAILABLE, ASCERTAIN BEST TIME TO CALL.

Lead in for respondent.

Hello, this is _____ calling from Braun Research. We are conducting research on the market for packaged commercial HVAC units in your area on behalf of Wisconsin Focus on Energy. We are not selling anything. We would like to interview someone in your firm who has detailed knowledge of recent sales of commercial HVAC equipment. All information you provide will be confidential and will not be linked in any way to you or your company. These questions will take about 15 minutes. In appreciation of your participation in the interview, your name will be entered into a drawing for a $1,000 prize.

SCREENING

1.1 In the past 12 months, has your firm sold at least 10 commercial packaged HVAC units from this location?

Yes.....1

No 2

Don't know.....8

Refused.....9

IF 1.1=1, ASK 2.1, ELSE TERMINATE

CLASSIFICATION/FIRMOGRAPHICS

2.1 Of the following, which best describes your firm's business?

Independent HVAC equipment distributor.....1

Manufacturer-owned or franchise distributor.....2

Independent manufacturers' representative.....3

Other (specify) _____.....4

Don't know.....8

Refused.....9

2.2 What is your title or position in the company?

Sales Manager 1

Sales Representative 2

Sales Engineer 3

General Manager.....4

Proprietor/CEO.....5

Other (_____).....6

2.3 How many locations does your firm have in Wisconsin?

ENTER NUMBER, 998 FOR DK, 999 FOR REF ....._____

2.4 How many full-time equivalent workers of all types do you employ at this location?

ENTER NUMBER OF FTEs, 998 FOR DK, 999 FOR REF ....._____

2.5 What percentage of your revenue from sales of HVAC equipment came from sales of commercial packaged HVAC units?

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

2.6 What percentage of the packaged HVAC units you sold last year were purchased by … ENTER PERCENT; 998 FOR DK, 999 FOR REF.

HVAC installation contractors .....____

Other types of installation contractors.....____

General contractors for new construction projects .....____

Facility owners and managers .....____

Other distributors and dealers.....____

Other types of businesses .....____

TOTAL.....100%

2.7 Do you sell commercial packaged HVAC units in Illinois?

Yes.....1

No 2

Don't Know.....9

IF 2.7 = 1 ASK 2.8, ELSE SKIP TO 3.1.

2.8 Roughly how many commercial packaged HVAC units did your firm sell in the last 12 months in Illinois?

ENTER NUMBER, 9998 FOR DK, 9999 FOR REF ....._____

EQUIPMENT SALES

Next I'd like to ask you about your firm's sales of commercial packaged HVAC equipment over the past 12 months.

ASK 3.1 – 3.4 IN SEQUENCE FOR EACH SIZE CATEGORY [a – d], THEN MOVE ON TO THE NEXT SIZE CATEGORY.

3.1 First, over the past 12 months, how many packaged commercial rooftop HVAC units did you sell in [SIZE CATEGORY a – d]?

3.2 FOR EACH SIZE CATEGORY [a – d] FOR WHICH 3.1>0, ASK:

3.2.a What percent of these units had an efficiency rating of 11.6 EER or higher?

3.2.b What percent of these units had an efficiency rating of 11.5 EER or higher?

3.2.c What percent of these units had an efficiency rating of 11.5 EER or higher?

3.2.d What percent of these units had an efficiency rating of 10.5 EER or higher?

3.3 FOR EACH SIZE CATEGORY a – d FOR WHICH 3.1>0, ASK: Last year what was the typical difference in cost between units that met this efficiency criterion and those that did not?

3.4 Do you currently have units that meet the efficiency criterion in stock?

Yes.....1

No 2

Don't know.....8

Refused.....9

	Size Category	3.1	3.2	3.3	3.4
a.	< 65 MBh or <5.4 tons				
b.	65 – 134 MBh or 5.4 – 11.25 tons				
c.	135 to 239 MBh or 11.25 – 20 tons				
d.	240 – 749 MBh or 20 – 62.4 tons				

3.5 What percent of units that you sold during the past 12 months were fitted with dual enthalpy economizers?

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

3.6 What percent of units that you sold during the past 12 months were fitted with CO2 sensors and demand control ventilation systems?

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

MARKET CONDITIONS

4.1 Over the past two years, has your company taken steps to promote high efficiency packaged HVAC units to contractors that you deal with?

Yes.....1

No 2

Don't know.....8
Refused.....9

IF 4.1=1, ASK 4.1.a. IF 4.1=2, ASK 4.5. ELSE ASK 4.7.

4.1.a Over the past 2 years, would you say that your firm's efforts to promote high-efficiency HVAC equipment have increased, decreased, or stayed about the same?

Increased 1

Decreased.....2

Stayed about the same.....3

Don't know.....8

Refused.....9

4.2 What kinds of activities has your company undertaken to promote high efficiency packaged HVAC units? DO NOT READ, ACCEPT MULTIPLES

Sales training for contractors 1

Technical training for contractors.....2

Production of brochures and other advertising materials 3
Media advertising 4

Technical support, such as savings calculators 5

Discounting or other favorable pricing for high efficiency units.....6

Other (Specify) _____.....97

Don't know.....98

Refused.....99

4.3 What do you think is the most important reason for a firm such as yours to promote high-efficiency equipment? DO NOT READ. ACCEPT ONE ONLY.

4.4 Are there other reasons? DO NOT READ. ACCEPT MULTIPLES.

Respondent	4.3	4.4
1. Competitors are doing it		
2. Increased revenue or margin		
3. Contractors are requesting it		
4. It's the right thing for the environment or economy		
5. Other (Specify)		

IF ASKED 4.3 AND 4.4 THEN SKIP TO 4.7.

4.5 What is the most important reason your company has not promoted high-efficiency HVAC units? DO NOT READ. ACCEPT ONE ONLY.

4.6 Are there other reasons? DO NOT READ. ACCEPT MULTIPLES.

Respondent	4.5	4.6
1. Contractors are not interested		
2. Our company lacks information		
3. Lack of equipment availability		
4. Lack of manufacturer support		
5. Other (Specify)		

4.7 Using a scale of 1 to 10, where 1 is 'not at all important' and 10 is 'very important': How important is the offer of energy efficient equipment in maintaining your firm's competitive position?

ENTER SCORE 1 – 10, 97 FOR DK..... _____

RESPONSE TO PROGRAM

5.1 Are you aware of the Wisconsin Focus on Energy programs for businesses?

Yes.....1

No 2

Don't know.....3

IF 5.1 = 1, ASK 5.1.a. ELSE SKIP TO 5.4.a.

5.1.a Have you supplied HVAC equipment to projects that have received incentives from Focus on Energy?

Yes.....1

No 2

Don't know.....3

IF 5.1.a = 1, ASK 5.1.b. ELSE SKIP TO 5.2.

5.1.b Roughly how many of the HVAC units you supplied in the past 12 months received incentives from Focus on Energy?

ENTER NUMBER OF PROJECTS, CODE 998 FOR DK, 999 FOR REF

____

5.2 Have you participated in any training programs sponsored or co-sponsored by Wisconsin Focus on Energy?

Yes.....1

No 2

Don't know.....3

IF 5.2 = 1, ASK 5.2.a. ELSE SKIP TO 5.3.

5.2.a In which program did you participate?

ENTER VERBATIM _____

IF 5.1 = 1 AND 4.1.a = 1 ASK 5.3, ELSE SKIP TO 5.4.

5.3 On a scale of 1 to 10, where 1 is not at all important and 10 is very important, how important were the Focus on Energy programs in your firm's decision to increase promotion of high-efficiency HVAC equipment?

ENTER 1 – 10, 98 FOR DK, 99 FOR REFUSED _____

5.4.a Have you participated in programs other than Focus on Energy that promote energy efficient technologies for businesses?

Yes.....1

No 2

Don't know.....3

IF 5.4.a = 1, ASK 5.4.b. ELSE SKIP TO 5.5.

5.4.b In which program did you participate?

ENTER VERBATIM_____

5.4.c Please describe the services you received?

ENTER VERBATIM_____

5.4.d On a scale of 1 to 10, where 1 is not at all important and 10 is very important, how important were these programs in your firm's decision to increase promotion of energy-efficient lighting equipment?

ENTER 1 – 10, 98 FOR DK, 99 FOR REFUSED .....____

ASK 5.5 – 5.7 IN SEQUENCE FOR TECHNOLOGIES [a – c] IN THE ANSWER GRID BELOW.

5.5 Over the past two years, has the share of [TECHNOLOGY a – c] that your company sells increased, decreased, or stayed about the same?

Increased.....1

Decreased 2

Stayed about the same 3

Don't know.....8

Refused 9

IF 5.5 [a-c] = 1, ASK 5.6 [a – c] and 5.7 [a – c] ELSE THANK AND CONCLUDE.

5.6 Using the year 2005 as a base, by what percent did the share of [NAME OF TECHNOLOGY a – c] you sold increase? Your best estimate is fine.

5.7 If Focus on Energy had not operated its programs, do you think the share of [NAME OF TECHNOLOGY a – c] would be lower, higher, or about the same as it actually is now?

Lower.....1

Higher.....2

Stayed about the same 3

Don't know.....8

Refused 9

Technology	**5.5**	**5.6**	**5.7**

a. High-efficiency packaged HVAC units			
b. Dual enthalpy economizers			
c. Demand control ventilation with CO2 sensors			

5.8 Finally, on a scale of 1 to 10, where 1 is no influence and 10 is a great deal of influence, how much influence do you think Focus on Energy programs have had on the market share high efficiency packaged HVAC units in your market area?

ENTER 1 – 10, 98 FOR DK, 99 FOR REFUSED _____

Record Contact Information for Drawing:

Name: _____

Address: _____

Phone: _____

Email: _____

THANK YOU FOR YOUR TIME AND COOPERATION.

WISCONSIN FOCUS ON ENERGY CONTRACT METRICS ASSESSMENT - 2008
ILLINOIS HVAC DISTRIBUTOR SURVEY

INTRODUCTION

Hi my name is _____. I'm calling from Braun Research, an energy research firm. We are conducting research on the market for commercial packaged HVAC units in your area in support of energy efficiency programs provided by various organizations in the Midwest. We are not selling anything.

May I speak with the person in your company who is most familiar with your firm's sales of commercial HVAC equipment?

ENTER NAME OF CONTACT: _____

IF CONTACT IS NOT AVAILABLE, ASCERTAIN BEST TIME TO CALL.

Lead in for respondent.

Hello, this is _____ calling from Braun Research. We are conducting research on the market for commercial packaged HVAC units in your area in support of energy efficiency programs provided by various organizations in the Midwest. We are not selling anything. We would like to interview someone in your firm who has detailed knowledge of recent sales of commercial HVAC equipment. All information you provide will be confidential and will not be linked in any way to you or your company. These questions will take about 15 minutes. In appreciation of your participation in the interview, your name will be entered into a drawing for a $1,000 prize.

SCREENING

1.1 In the past 12 months, has your firm sold at least 10 commercial packaged HVAC units from this location?

Yes.....1

No 2

Don't know.....8

Refused.....9

IF 1.1=1, ASK 2.1, ELSE TERMINATE.

CLASSIFICATION/FIRMOGRAPHICS

2.1 Of the following, which best describes your firm's business?

Independent HVAC equipment distributor.....1

Manufacturer-owned or franchise distributor.....2

Independent manufacturers' representative.....3

Other (specify) _____.....4

Don't know.....8

Refused.....9

2.2 What is your title or position in the company?

Sales Manager 1

Sales Representative 2

Sales Engineer 3

General manager.....4

Proprietor/CEO.....5

Other (_____).....6

2.3 How many locations does your firm have in Illinois?

ENTER NUMBER, 998 FOR DK, 999 FOR REF ....._____

2.4 How many full-time equivalent workers of all types do you employ at this location?

ENTER NUMBER OF FTEs, 998 FOR DK, 999 FOR REF ....._____

2.5 What percentage of your revenue from sales of HVAC equipment came from sales of commercial packaged HVAC units?

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

2.6 What percentage of the packaged HVAC units you sold last year were purchased by … ENTER PERCENT; 998 FOR DK, 999 FOR REF.

HVAC installation contractors .....____

Other types of installation contractors.....____

General contractors for new construction projects .....____

Facility owners and managers .....____

Other distributors and dealers.....____

Other types of businesses .....____

TOTAL.....100%

2.7 Do you sell commercial packaged HVAC units in Wisconsin?

Yes.....1

No 2

Don't Know.....9

IF 2.7 = 1 ASK 2.8, ELSE SKIP TO 3.1.

2.8 Roughly how many commercial packaged HVAC units did your firm sell in the last 12 months in Wisconsin?

ENTER NUMBER, 9998 FOR DK, 9999 FOR REF ....._____

EQUIPMENT SALES

Next I'd like to ask you about your firm's sales of commercial packaged HVAC equipment over the past 12 months.

ASK 3.1 – 3.4 IN SEQUENCE FOR EACH SIZE CATEGORY [a – d], THEN MOVE ON TO THE NEXT SIZE CATEGORY.

3.1 First, over the past 12 months, how many packaged commercial rooftop HVAC units did you sell in [SIZE CATEGORY a – d]?

3.2 FOR EACH SIZE CATEGORY [a – d] FOR WHICH 3.1>0, ASK:

3.2.a What percent of these units had an efficiency rating of 11.6 EER or higher?

3.2.b What percent of these units had an efficiency rating of 11.5 EER or higher?

3.2.c What percent of these units had an efficiency rating of 11.5 EER or higher?

3.2.d What percent of these units had an efficiency rating of 10.5 EER or higher?

3.3 FOR EACH SIZE CATEGORY a – d FOR WHICH 3.1>0, ASK: Last year what was the typical difference in cost between units that met this efficiency criterion and those that did not?

3.4 Do you currently have units that meet the efficiency criterion in stock?

Yes.....1

No 2

Don't know.....8

Refused.....9

	Size Category	3.1	3.2	3.3	3.4
a.	<65 MBh or <5.4 tons				
b.	65 – 134 MBh or 5.4 – 11.25 tons				
c.	135 to 239 MBh or 1.25 – 20 tons				
d.	240 – 749 MBh or 20 – 62.4 tons				

3.5 What percent of units that you sold during the past 12 months were fitted with dual enthalpy economizers?

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

3.6 What percent of units that you sold during the past 12 months were fitted with CO2 sensors and demand control ventilation systems?

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

MARKET CONDITIONS

4.1 Over the past two years, has your company taken steps to promote high efficiency packaged HVAC units to contractors that you deal with?

Yes.....1

No 2

Don't know.....8

Refused.....9

IF 4.1=1, ASK 4.1.a. IF 4.1=2, ASK 4.5. ELSE ASK 4.7.

4.1.a Over the past 2 years, would you say that your firm's efforts to promote high-efficiency HVAC equipment have increased, decreased, or stayed about the same?

Increased 1

Decreased.....2

Stayed about the same.....3

Don't know.....8

Refused.....9

4.2 What kinds of activities has your company undertaken to promote high efficiency packaged HVAC units? DO NOT READ, ACCEPT MULTIPLES.

Sales training for contractors 1

Technical training for contractors.....2

Production of brochures and other advertising materials 3
Media advertising 4

Technical support, such as savings calculators 5

Discounting or other favorable pricing for high efficiency units.....6

Other (Specify) _____.....97

Don't know.....98

Refused.....99

4.3 What do you think is the most important reason for a firm such as yours to promote

high-efficiency equipment? DO NOT READ. ACCEPT ONE ONLY.

4.4 Are there other reasons? DO NOT READ. ACCEPT MULTIPLES.

Respondent	4.3	4.4
1. Competitors are doing it		
2. Increased revenue or margin		
3. Contractors are requesting it		
4. It's the right thing for the environment or economy		
5. Other (Specify)		

IF ASKED 4.3 AND 4.4 THEN SKIP TO 4.7.

4.5 What is the most important reason your company has not promoted high-efficiency HVAC units? DO NOT READ. ACCEPT ONE ONLY.

4.6 Are there other reasons? DO NOT READ. ACCEPT MULTIPLES.

Respondent	4.5	4.6
1. Contractors are not interested		
2. Our company lacks information		
3. Lack of equipment availability		
4. Lack of manufacturer support		
5. Other (Specify)		

4.7 Using a scale of 1 to 10, where 1 is 'not at all important' and 10 is 'very important': How important is the offer of energy efficient equipment in maintaining your firm's competitive position?

ENTER SCORE 1 – 5, 97 FOR DK..... _____

MARKET TRENDS

5.1.a Have you participated in any government or utility programs that promote energy efficient technologies for businesses?

Yes.....1

No 2

Don't know.....3

IF 5.1.a = 1, ASK 5.1.b. ELSE SKIP TO 5.2.

5.1.b In which program did you participate?

ENTER VERBATIM_____

5.1.c Please describe the services you received?

ENTER VERBATIM_____

5.1.d On a scale of 1 to 10, where 1 is not at all important and 10 is very important, how important were these programs in your firm's decision to increase promotion of energy-efficient lighting equipment?

ENTER 1 – 10, 98 FOR DK, 99 FOR REFUSED .....____

ASK 5.2 – 5.3 IN SEQUENCE FOR TECHNOLOGIES [a – c] IN THE ANSWER GRID BELOW.

5.2 Over the past two years, has the share of [TECHNOLOGY a – c] that your company sells increased, decreased, or stayed about the same?

Increased 1

Decreased.....2

Stayed about the same.....3

Don't know.....8

Refused.....9

IF 5.2 [a-c] = 1, ASK 5.3 [a – c], ELSE THANK AND CONCLUDE.

5.3 Using the year 2005 as a base, by what percent did the share of [NAME OF TECHNOLOGY a – c] you sold increase? Your best estimate is fine.

Technology	**5.2**	**5.3**
a. High-efficiency packaged HVAC units		
b. Dual enthalpy economizers		
c. Demand control ventilation with CO2 sensors		

Record Contact Information for Drawing:

Name: _____

Address: _____

Phone: _____

Email: _____

THANK YOU FOR YOUR TIME AND COOPERATION.

WISCONSIN FOCUS ON ENERGY CONTRACT METRICS ASSESSMENT - 2008

WISCONSIN VFD END-USER SURVEY

INTRODUCTION

Hi my name is _____. I'm calling from Research America, an energy research firm. We are conducting research on air compressors, industrial pumps, and fans on behalf of Wisconsin Focus on Energy. I am not selling anything.

May I please speak with the person at this location who is most knowledgeable about decisions affecting your mechanical equipment such air compressors, industrial pumps, and fans?

ENTER NAME OF CONTACT: _____

IF CONTACT IS NOT AVAILABLE, ASCERTAIN BEST TIME TO CALL.

Lead in for respondent.

Hello, this is _____ calling from Research America. We are conducting research on mechanical equipment such as air compressors, industrial pumps, and fans on behalf of Wisconsin Focus on Energy. All information you provide will be confidential and will not be linked in any way to you or your company. These questions will take about 15 minutes. In appreciation for completion of the interview, you will be entered into a drawing for a $1,000 prize.

SCREENING QUESTIONS AND FIRMOGRAPHICS

1.1 What is the principal activity conducted at this facility? [IF NEEDED:] This may not be the main activity of your organization, but should be the main activity that occurs at this location. [PROMPT IF NEEDED. RECORD ONE RESPONSE.]

Manufacturing – Process Industries.....1

Manufacturing – Assembly 2

Paper or Pulp Industry.....3

Other (Thank and Terminate) 97

Don't Know (Thank and Terminate) 98

Refused (Thank and Terminate).....99

1.2 What products do you manufacture at this location? [ENTER ANSWERS VERBATIM.]

_____

1.3 How many full-time employees work at this location?

ENTER NUMBER, 999998 FOR DK, 999999 FOR REF....._____

1.4 How many part-time employees work at this location?

ENTER NUMBER, 999998 FOR DK, 999999 FOR REF....._____

1.5 Approximately how many square feet of enclosed space does your company occupy at this location? Your best estimate is fine.

ENTER NUMBER, 99999998 FOR DK, 99999999 FOR REF....._____

1.6 Does your company have facilities in Illinois?

Yes.....1

No 2

Don't Know.....98

Refused.....99

MOTORS

0.1 Has your company purchased any VFDs (variable frequency drives), also called adjustable speed drives, in the past two years?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 0.1 = 1, ASK 0.2. ELSE SKIP TO 2.1.

0.2 How many of the VFDs purchased in the past two years are fitted to motors in the following size categories [READ EACH SIZE CATEGORY]? ENTER NUMBER, 998 FOR DK, 999 FOR REF.

FOR EACH MOTOR FITTED WITH A NEW VFD ASK 0.3.

0.3 What production equipment is run with this motor?

	Size Category	0.2	0.3
A	1 – 20 hp		
B	21 – 50 hp		
C	51 – 100 hp		
D	101 – 200 hp		
E	Greater than 200 hp		

This next series of questions concerns electric motors used to run production equipment in your facility.

2.1 First, can you tell me roughly how many motors you have in your facility? We are interested on in motors that run the production equipment; not those used in space conditioning systems?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

2.2 How many of these motors are greater than 200 horsepower?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.2>0, ASK 2.2.a. ELSE SKIP TO 2.3.

2.2.a How many of these motors over 200 horsepower drive variable loads?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.2.a>0, ASK 2.2.b. ELSE SKIP TO 2.3.

2.2.b And how many of these motors are fitted with variable frequency drives or VFDs?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

2.3 How many of your production equipment motors are from 101 to 200 horsepower?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.3>0, ASK 2.3.a. ELSE SKIP TO 2.4.

2.3.a. How many of those motors drive variable loads?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.3.a>0, ASK 2.3.b. ELSE SKIP TO 2.4.

2.3.b And how many of those motors are fitted with variable frequency drives?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

2.4 How many of your production equipment motors are from 51 to 100 horsepower?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.4>0, ASK 2.4.a. ELSE SKIP TO 2.5.

2.4.a How many of those drive variable loads?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.4.a>0, ASK 2.4.b. ELSE SKIP TO 2.5.

2.4.b And how many of those motors are fitted with variable frequency drives?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

2.5 How many of your production equipment motors are from 21 to 50 horsepower?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.5>0, ASK 2.5.a. ELSE SKIP TO 2.6.

2.5.a How many of those drive variable loads?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.5.a>0, ASK 2.5.b. ELSE SKIP TO 2.6.

2.5.b And how many of those motors are fitted with variable frequency drives?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

2.6 What percent of your production motors from 1 to 20 horsepower drive variable loads?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.6>0, ASK 2.6.a. ELSE SKIP TO 2.7.

2.6.a And what percent of these motors are fitted with variable frequency drives?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

2.7 Do you believe that your company has taken advantage of…

All available opportunities to benefit from variable frequency drives ...1

Most of those opportunities.....2

Some of those opportunities 3

Few of those opportunities, OR 4

None of those opportunities.....5

Don't know.....8

Refused.....9

2.8 What do you think is the most important reason for a firm such as yours to use VFDs?

DO NOT READ. ACCEPT ONE ONLY.

2.9 Are there other reasons? DO NOT READ. ACCEPT MULTIPLES.

Respondent	**2.8**	**2.9**
1. Energy savings		
2. Increased revenue or margin		
3. Increased productivity		
4. Increased reliability		
5. Other (Specify)		

IF 2.7 = 3, 4, OR 5, ASK 2.10. ELSE SKIP TO 2.12.

2.10 What is the most important reason that your company has NOT taken advantage of more opportunities to benefit from VFDs? [CHECK ONE ONLY. PROMPT IF NEEDED.]

2.11 Were there other reasons? [ACCEPT MULTIPLES. PROMPT IF NEEDED.]

		2.10	2.11
1	Cost was too high.		
2	Energy savings don't justify costs of VFDs		
3	Motors in this plant are too small		
4	Motors in this plant run at constant speed		
5	Static loads too high		
6	Not enough motor operating hours to justify investment		
7	Dealers did not have models to fit application		
8	Not sure about application of VFD technology to equipment operations		
9	Concerned about reliability of VFDs		
10	Not sure that existing equipment could be retrofitted with VFDs		
11	Chose another energy savings measure		
12	Installation/training takes too long		
13	Not aware of VFDs		
97	Other (specify)		
98	Don't know		
99	Refused		

2.12 Roughly how many AC electric motors from 1 to 200 HP did your company purchase for use in this facility in the past 12 months?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.12>0, ASK 2.12.a. ELSE SKIP TO 2.12.b.

2.12.a What percentage of these new motors were rated as NEMA Premium Efficiency motors?

ENTER PERCENT, 998 FOR DK, 999 FOR REF.....____

IF 2.12.a = DK, ASK 2.12.b. ELSE SKIP TO 3.1.

2.12.bHave you heard of NEMA Premium Efficiency Motors?

Yes.....1

No 2

Don't Know.....8

Refused.....9

USE OF VFDS IN COMPRESSED AIR SYSTEMS

3.1 Is there a compressed air system at this location?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 3.1 = 1, ASK 3.2. ELSE SKIP TO 4.1.

3.2 How many compressors are there in the system?

ENTER NUMBER OF COMPRESSORS,

9998 FOR DK, 9999 FOR REF....._____

IF 3.2 > 1, SKIP TO 3.5. ELSE ASK 3.3.

3.3 What is the horsepower rating of the compressor?

ENTER COMPRESSOR HORSEPOWER,

9998 FOR DK, 9999 FOR REF....._____

3.4 Is this compressor fitted with a variable frequency drive?

Yes.....1

No 2

Don't Know.....8

Refused.....9

SKIP TO 3.9

3.5 What is the horsepower of the lead compressor, that is: the compressor that operates the greatest number of hours in the course of a year?

ENTER COMPRESSOR HORSEPOWER,

9998 FOR DK, 9999 FOR REF....._____

3.6 Is this compressor fitted with a variable frequency drive?

Yes.....1

No 2

Don't Know.....8

Refused.....9

3.7 ASK INDIVIDUALLY FOR COMPRESSOR #2 THROUGH LAST COMPRESSOR MENTIONED IN 3.2. What is the horsepower of the [second, third, etc.] compressor?

ENTER COMPRESSOR HORSEPOWER,

9998 FOR DK, 9999 FOR REF....._____

3.8 Is this compressor fitted with a variable frequency drive?

Yes.....1

No 2

Don't Know.....8

Refused.....9

		3.7	3.8
A	Second Compressor		
B	Third Compressor		
C	Fourth Compressor		
D	Fifth Compressor		
E	Sixth Compressor		
F	Seventh Compressor		
G	Eighth Compressor		

3.9 Wisconsin Focus on Energy has offered customized advice and incentives for VFD-controlled compressed air systems. Did your firm have a Focus on Energy custom evaluation of the air compression system between 2001 and 2007?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 3.9 = 1, ASK 3.10. IF 3.9 = 2, ASK 3.12. ELSE SKIP TO 4.1.

3.10 Prior to the compressed air system evaluation you received from Wisconsin Focus on Energy, had you used VFDs to control air compressors in this facility?

Yes.....1

No 2

Don't Know.....8

Refused.....9

3.11 On a scale of 1 to 10, where 10 is very important and 1 is not at all important, how important were the Focus on Energy programs in your decisions to install VFD controls in your compressed-air systems in this facility or in other facilities in Wisconsin?

ENTER 1-10, 9998 FOR DK, 9999 FOR REF....._____

SKIP TO 4.1.

3.12 Why has your firm not requested a custom evaluation of its compressed air system? [ENTER ANSWERS VERBATIM.]

_____

INDUSTRIAL FANS AND PUMPS

4.1 Do you use fans or blower systems in the production equipment installed at this facility?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.1 = 1, ASK 4.1.a, ELSE SKIP TO 4.5.

4.1.a What is the total horsepower of the motors that drive fan and blower systems in this facility? Your best estimate will be fine.

ENTER HORSEPOWER, 9998 FOR DK, 9999 FOR REF....._____

4.2 Are any of the motors for these fans and blowers controlled by VFDs?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.2 = 1, ASK 4.3 and 4.4. IF 4.2 NOT 1 ASK 4.3, THEN SKIP TO 4.5.

4.3 Approximately what percentage of the total installed horsepower of your fan and blower systems falls in the [READ SIZE CATEGORY] category? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

4.4 And what percentage of the fans and blowers in that category are controlled by VFDs? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

	Size Category	4.3	4.4
A	1 – 5 hp		
B	6 – 20 hp		
C	21 – 50 hp		
D	> 50 hp		

4.5 Do you use pump systems in the production equipment installed at this facility?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.5 = 1, ASK 4.5.a, ELSE SKIP TO 4.9.

4.5.a What is the total horsepower of the motors that drive pump systems in this facility? Your best estimate will be fine.

ENTER HORSEPOWER, 9998 FOR DK, 9999 FOR REF....._____

4.6 Are any of the motors for these pumps controlled by VFDs?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.6 = 1, ASK 4.7 and 4.8. IF 4.6 NOT 1 ASK 4.7, THEN SKIP TO 4.9.

4.7 Approximately what percentage of the total installed horsepower of your pump systems falls in the [READ SIZE CATEGORY] category? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

4.8 And what percentage of the pumps in that category are controlled by VFDs? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

	Size Category	4.6	4.7
A	1 – 5 hp		
B	6 – 20 hp		
C	21 – 50 hp		
D	51 – 100 hp		
E	Greater than 100 hp		

4.9 Are you aware that Wisconsin Focus on Energy has an incentive program to promote VFD-controlled industrial pumps and fans?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.9 = 1, ASK 4.10, ELSE SKIP TO 4.11.

4.10 Did your company receive incentives from that program to purchase VFDs for use in fan, blower, or pump systems in this facility?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.10 = 1, ASK 4.10.a, ELSE SKIP TO 4.11.

4.10.a How many VFDs has your company purchased with the assistance of financial incentives from Focus on Energy?

ENTER NUMBER, 999998 FOR DK, 999999 FOR REF....._____

IF 1.1 = 3 (principal activity = Pulp & Paper Industry) ASK 4.11, ELSE IF 4.10 = 1, SKIP TO 4.13, ELSE SKIP TO 4.15.

4.11 Are you aware that Wisconsin Focus on Energy offers a special study incentive to Wisconsin Pulp and Paper industry to identify pump system energy efficiency opportunities?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.11 = 1 ASK 4.12, ELSE IF 4.10 = 1 SKIP TO 4.13, ELSE SKIP TO 4.15.

4.12 Did your company receive a special study incentive to assess pump system energy efficiency opportunities?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.10 = 1 OR 4.12 = 1 ASK 4.13, ELSE SKIP TO 4.15.

4.13 Prior to participating in the Focus on Energy program, had you used VFDs to control pumps, fans, or blowers in this facility or other facilities you operate in Wisconsin?

Yes.....1

No 2

Don't Know.....8

Refused.....9

4.14 On a scale of 1 to 10, where 10 is very important and 1 is not at all important, how important were the Focus on Energy programs in your decisions to install VFDs to control pumps, fans, or blowers in this facility or other you operate in Wisconsin?

ENTER 1-10, 9998 FOR DK, 9999 FOR REF....._____

4.15 Have you participated in programs other than Focus on Energy that promote energy efficient technologies for businesses?

Yes.....1

No 2

Don't know.....3

IF 4.15 = 1, ASK 4.16 ELSE THANK AND END SURVEY.

4.16 In which program did you participate?

ENTER VERBATIM_____

4.17 Please describe the services you received?

ENTER VERBATIM_____

4.18 On a scale of 1 to 10, where 1 is not at all important and 10 is very important, how important were these programs in your firm's decision to install VFDs?

ENTER 1 – 10, 98 FOR DK, 99 FOR REFUSED ....._____

Contact Information for Drawing:

Name: _____

Address: _____

Phone: _____

Email: _____

THANK YOU FOR YOUR TIME AND COOPERATION.

WISCONSIN FOCUS ON ENERGY CONTRACT METRICS ASSESSMENT – 2008
ILLINOIS VFD END-USER SURVEY

INTRODUCTION

Hi my name is _____. I'm calling from Research America, an energy research firm. We are conducting research on air compressors, industrial pumps, and fans in support of energy efficiency programs provided by various organizations in the Midwest. I am not selling anything.

May I please speak with the person at this location who is most knowledgeable about decisions affecting your mechanical equipment such air compressors, industrial pumps, and fans?

ENTER NAME OF CONTACT: _____

IF CONTACT IS NOT AVAILABLE, ASCERTAIN BEST TIME TO CALL.

Lead in for respondent.

Hello, this is _____ calling from Research America. We are conducting research on mechanical equipment such as air compressors, industrial pumps, and fans in support of energy efficiency programs provided by various organizations in the Midwest. All information you provide will be confidential and will not be linked in any way to you or your company. These questions will take about 15 minutes. In appreciation for completion of the interview, you will be entered into a drawing for a $1,000 prize.

SCREENING QUESTIONS AND FIRMOGRAPHICS

1.1 What is the principal activity conducted at this facility? [IF NEEDED:] This may not be the main activity of your organization, but should be the main activity that occurs at this location. [PROMPT IF NEEDED. RECORD ONE RESPONSE.]

Manufacturing – Process Industries.....1

Manufacturing – Assembly 2

Paper or Pulp Industry.....3

Other (Thank and Terminate) 97

Don't know (Thank and Terminate).....98

Refused (Thank and Terminate) 99

1.2 What products do you manufacture at this location? [ENTER ANSWERS VERBATIM.]

_____

1.3 How many full-time employees work at this location?

ENTER NUMBER, 999998 FOR DK, 999999 FOR REF....._____

1.4 How many part-time employees work at this location?

ENTER NUMBER, 999998 FOR DK, 999999 FOR REF....._____

1.5 Approximately how many square feet of enclosed space does your company occupy at this location? Your best estimate is fine.

ENTER NUMBER, 99999998 FOR DK, 99999999 FOR REF....._____

1.6 Does your company have facilities in Wisconsin?

Yes.....1

No 2

Don't Know.....98

Refused.....99

MOTORS

0.1 Has your company purchased any VFDs (variable frequency drives), also called adjustable speed drives, in the past two years?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 0.1 = 1, ASK 0.2. ELSE SKIP TO 2.1.

0.2 How many of the VFDs purchased in the past two years are fitted to motors in the following size categories [READ EACH SIZE CATEGORY]? ENTER NUMBER, 998 FOR DK, 999 FOR REF.

FOR EACH MOTOR FITTED WITH A NEW VFD ASK 0.3.

0.3 What production equipment is run with this motor?

	Size Category	0.2	0.3
A	1 – 20 hp		
B	21 – 50 hp		
C	51 – 100 hp		
D	101 – 200 hp		
E	Greater than 200 hp		

This next series of questions concerns electric motors used to run production equipment in your facility.

2.1 First, can you tell me roughly how many motors you have in your facility? We are interested on in motors that run the production equipment; not those used in space conditioning systems?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

2.2 How many of these motors are greater than 200 horsepower?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.2>0, ASK 2.2.a. ELSE SKIP TO 2.3.

2.2.a How many of these motors over 200 horsepower drive variable loads?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.2.a>0, ASK 2.2.b. ELSE SKIP TO 2.3.

2.2.b And how many of these motors are fitted with variable frequency drives or VFDs?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

2.3 How many of your production equipment motors are from 101 to 200 horsepower?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.3>0, ASK 2.3.a. ELSE SKIP TO 2.4.

2.3.a How many of those motors drive variable loads?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.3.a>0, ASK 2.3.b. ELSE SKIP TO 2.4.

2.3.b And how many of those motors are fitted with variable frequency drives?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

2.4 How many of your production equipment motors are from 51 to 100 horsepower?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.4>0, ASK 2.4.a. ELSE SKIP TO 2.5.

2.4.a How many of those drive variable loads?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.4.a>0, ASK 2.4.b. ELSE SKIP TO 2.5.

2.4.b And how many of those motors are fitted with variable frequency drives?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

2.5 How many of your production equipment motors are from 21 to 50 horsepower?_____

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.5>0, ASK 2.5.a. ELSE SKIP TO 2.6.

2.5.a How many of those drive variable loads?

ENTER NUMBER, 9998 FOR DK, 9999 FOR REF ....._____

IF 2.5.a>0, ASK 2.5.b. ELSE SKIP TO 2.6.

2.5.b And how many of those motors are fitted with variable frequency drives?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

2.6 What percent of your production motors from 1 to 20 horsepower drive variable loads?

ENTER PERCENT, 9998 FOR DK, 9999 FOR REF....._____

IF 2.6>0, ASK 2.6.a. ELSE SKIP TO 2.7.

2.6.a And what percent of these motors are fitted with variable frequency drives?

ENTER PERCENT, 9998 FOR DK, 9999 FOR REF....._____

2.7 Do you believe that your company has taken advantage of…

All available opportunities to benefit from variable frequency drives ...1

Most of those opportunities.....2

Some of those opportunities 3

Few of those opportunities, OR 4

None of those opportunities.....5

Don't know.....8

Refused.....9

2.8 What do you think is the most important reason for a firm such as yours to use VFDs?

DO NOT READ. ACCEPT ONE ONLY.

2.9 Are there other reasons? DO NOT READ. ACCEPT MULTIPLES.

Respondent	**2.8**	**2.9**
1. Energy savings		
2. Increased revenue or margin		
3. Increased productivity		
4. Increased reliability		
5. Other (Specify)		

IF 2.7 = 3, 4, OR 5, ASK 2.10. ELSE SKIP TO 2.12.

2.10 What is the most important reason that your company has NOT taken advantage of more opportunities to benefit from VFDs? [CHECK ONE ONLY. PROMPT IF NEEDED.]

2.11 Were there other reasons? [ACCEPT MULTIPLES. PROMPT IF NEEDED.]

		2.10	2.11
1	Cost was too high.		
2	Energy savings don't justify costs of VFDs		
3	Motors in this plant are too small		
4	Motors in this plant run at constant speed		
5	Static loads too high		
6	Not enough motor operating hours to justify investment		
7	Dealers did not have models to fit application		
8	Not sure about application of VFD technology to equipment operations		
9	Concerned about reliability of VFDs		
10	Not sure that existing equipment could be retrofitted with VFDs		
11	Chose another energy savings measure		
12	Installation/training takes too long		
13	Not aware of VFDs		
97	Other (specify)		
98	Don't know		
99	Refused		

2.12 Roughly how many AC electric motors from 1 to 200 HP did your company purchase for use in this facility in the past 12 months?

ENTER NUMBER OF MOTORS, 9998 FOR DK, 9999 FOR REF_____

IF 2.12>0, ASK 2.12.a. ELSE SKIP TO 2.12.b.

2.12.aWhat percentage of these new motors were rated as NEMA Premium Efficiency motors?

ENTER PERCENT, 998 FOR DK, 999 FOR REF....._____

IF 2.12.a = DK, ASK 2.12.b. ELSE SKIP TO 3.1.

2.12.bHave you heard of NEMA Premium Efficiency Motors?

Yes.....1

No 2

Don't Know.....8

Refused.....9

USE OF VFDS IN COMPRESSED AIR SYSTEMS

3.1 Is there a compressed air system at this location?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 3.1 = 1, ASK 3.2. ELSE SKIP TO 4.1.

3.2 How many compressors are there in the system?

ENTER NUMBER OF COMPRESSORS ....._____

IF 3.2 > 1, SKIP TO 3.5. ELSE ASK 3.3.

3.3 What is the horsepower rating of the compressor?

ENTER COMPRESSOR HORSEPOWER,

9998 FOR DK, 9999 FOR REF....._____

3.4 Is this compressor fitted with a variable frequency drive?

Yes.....1

No 2

Don't Know.....8

Refused.....9

SKIP TO 4.1

3.5 What is the horsepower of the lead compressor, that is: the compressor that operates the greatest number of hours in the course of a year?

ENTER COMPRESSOR HORSEPOWER,

9998 FOR DK, 9999 FOR REF....._____

3.6 Is this compressor fitted with a variable frequency drive?

Yes.....1

No 2

Don't Know.....8

Refused.....9

3.7 ASK INDIVIDUALLY FOR COMPRESSOR #2 THROUGH LAST COMPRESSOR MENTIONED IN C2. What is the horsepower of the [second, third, etc.] compressor?

ENTER COMPRESSOR HORSEPOWER,

9998 FOR DK, 9999 FOR REF....._____

3.8 Is this compressor fitted with a variable frequency drive?

Yes.....1

No 2

Don't Know.....8

Refused.....9

		3.7	3.8
A	Second Compressor		
B	Third Compressor		
C	Fourth Compressor		
D	Fifth Compressor		
E	Sixth Compressor		
F	Seventh Compressor		
G	Eighth Compressor		

INDUSTRIAL FANS AND PUMPS

4.1 Do you use fans or blower systems in the production equipment installed at this facility?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.1 = 1, ASK 4.1.a, ELSE SKIP TO 4.5.

4.1.a What is the total horsepower of the motors that drive fan and blower systems in this facility? Your best estimate will be fine.

ENTER HORSEPOWER, 9998 FOR DK, 9999 FOR REF....._____

4.2 Are any of the motors for these fans and blowers controlled by VFDs?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.2 = 1, ASK 4.3 and 4.4. IF 4.2 NOT 1 ASK 4.3, THEN SKIP TO 4.5.

4.3 Approximately what percentage of the total installed horsepower of your fan and blower systems falls in the [READ SIZE CATEGORY] category? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

4.4 And what percentage of the fans and blowers in that category are controlled by VFDs? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

	Size Category	4.3	4.4
A	1 – 5 hp		
B	6 – 20 hp		
C	21 – 50 hp		
D	> 50 hp		

4.5 Do you use pump systems in the production equipment installed at this facility?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.5 = 1, ASK 4.5.a, ELSE END SURVEY.

4.5.a What is the total horsepower of the motors that drive pump systems in this facility? Your best estimate will be fine.

ENTER HORSEPOWER, 9998 FOR DK, 9999 FOR REF....._____

4.6 Are any of the motors for these pumps controlled by VFDs?

Yes.....1

No 2

Don't Know.....8

Refused.....9

IF 4.6 = 1, ASK 4.7 and 4.8. IF 4.6 NOT 1 ASK 4.7, THEN END SURVEY.

4.7 Approximately what percentage of the total installed horsepower of your pump systems falls in the [READ SIZE CATEGORY] category? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

4.8 And what percentage of the pumps in that category are controlled by VFDs? ENTER PERCENT, 998 FOR DK, 999 FOR REF.

	Size Category	4.7	4.8
A	1 – 5 hp		
B	6 – 20 hp		
C	21 – 50 hp		
D	51 – 100 hp		
E	Greater than 100 hp		

4.9 Have you participated in any government or utility programs that promote energy efficient technologies for businesses?

Yes.....1

No 2

Don't know.....3

IF 4.9 = 1, ASK 4.10 ELSE THANK AND END SURVEY.

4.10 In which program did you participate?

ENTER VERBATIM_____

4.11 Please describe the services you received?

ENTER VERBATIM_____

4.12 On a scale of 1 to 10, where 1 is not at all important and 10 is very important, how important were these programs in your firm's decision to install VFDs?

ENTER 1 – 10, 98 FOR DK, 99 FOR REFUSED .....____

Contact Information for Drawing:

Name: _____

Address: _____

Phone: _____

Email: _____

THANK YOU FOR YOUR TIME AND COOPERATION.

Attachment A-2
Program Metrics
Business Programs: Lighting Channel Strategy
18-Month Contract Period: July 1, 2007, through December 31, 2008

Primary Program Activities	Critical Barriers	Critical Goals	Critical Metrics	Critical Milestones	Comments
Provide prescriptive incentives, training and information to substantially increase the use of high efficiency fluorescent systems for high-bay lighting instead of or to replace HID lighting systems.	Lack of Awareness of opportunity with some market segments and financial barrier with customers with lower hours of operation.	Increase net Wisconsin market share of high bay fluorescent lighting systems compared to increase in net market share in Illinois, and to standard HID technology.	Increase in net Wisconsin market share of high bay fluorescent lighting systems, across all market segments, compared to any increase in net market share from Illinois baseline, and to standard HID technology.	Establish high bay fluorescent lighting baseline, across all market segments, for Wisconsin and Illinois by January of 2008.At the end of 2010 program year, Wisconsin will have a 10% greater growth in net market share of high bay fluorescent lighting systems, compared to Wisconsin baseline, than any increase in net market share from Illinois baseline, and to standard HID technology.	High bay fluorescent lighting has been marketed and promoted by the Focus program for the last 6 years. It is important to understand the status of new and replacement markets for high bay fluorescents in comparison to Illinois, relative to standard HID technology, and to understand the impact of potentially reduced Focus support for this technology on the stability of the market.

Attachment A-2
Program Metrics
Business Programs: BP HVAC
18-Month Contract Period: July 1, 2007, through December 31, 2008

Primary Program Activities	Critical Barriers	Critical Goals	Critical Metrics	Critical Milestones	Comments
Provide prescriptive incentives, training and information to substantially increase the use of high efficiency rooftop units.	Lack of Awareness of opportunity with some market segments and initial cost barrier.	Increase the net Wisconsin market share of high efficiency rooftop units in commercial, school and government buildings. Efficiency of units is based on size (See below). < 65 MBh ≥11.3 EER 65-134 MBh ≥11.0 EER 135-239 MBh ≥10.8 EER 240-300 MBh ≥10.0 EER	Increase in net Wisconsin market share of high efficiency rooftop units in commercial, school and government buildings, in comparison to increase in net market share from Illinois baseline.	Establish high efficiency roof top unit baselines for Wisconsin and Illinois by January of 2008. At the end of 2010 program year, Wisconsin will have 10% greater growth in market share of high efficiency rooftop units in commercial, school and government buildings, compared to Wisconsin baseline, than any increase in market share from Illinois baseline.	The program is going to increase its focus on high efficiency rooftop units. The program has been promoting this technology for several years, however this year the incentives will triple. We will be promoting the technology through trade allies in order to reach their end use customers rather than targeting a specific type of end user. Based on past trends, most but not all of these systems will be installed in either commercial or school/government customer locations.

Attachment A-2
Program Metrics
Business Programs: BP Rotary
18-Month Contract Period: July 1, 2007, through December 31, 2008

	Participant/Market Effects				
Primary Program Activities	**Critical Barriers**	**Critical Goals**	**Critical Metrics**	**Critical Milestones**	**Comments**
Increase the market share of NEMA Premium Motors compared to market share for standard motors	High initial cost, lack of inventory/availability for same day replacements, lack of awareness of benefits/payback among end users and market providers, lack of investment in promotion by market providers, cumbersome incentive claim process.	Increase net Wisconsin market share of NEMA premium motors up to 200 HP compared to baseline established in the 2006 KEMA motors study	Increase in net Wisconsin market share of NEMA premium motors up to 200 HP compared to baseline established in the 2006 KEMA motors study. Periodic report on progress in October, 2007 and 2008.	Increase net market share of NEMA premium motors up to 200 HP by 10% over naturally occurring levels by end of 2010 program year.	CEE collects shipping data by state from motor manufacturers that can be used to track market share.

	Participant/Market Effects				
Primary Program Activities	**Critical Barriers**	**Critical Goals**	**Critical Metrics**	**Critical Milestones**	**Comments**
Provide prescriptive incentives, results of special Paper sector study incentive, training and information to substantially increase the use of VFD to control pump and fan flows.	Lack of awareness of opportunity, system complexity, and financial barriers lower hours of operation.	Increase net Wisconsin market share of VFD controlled Industrial pump and fan flows, compared to market share in Illinois.	Increase in net Wisconsin market share of VFD controlled industrial pump and fan flows, compared to increase in net market share from Illinois baseline.	Establish Wisconsin and Illinois baselines for market share of VFD controlled industrial pumps and fans by January 2008. By the end of 2010 program year, Wisconsin will have 5% greater growth in net market share of VFD controlled industrial pumps and fans, compared to Wisconsin baseline, than any increase in net market share from Illinois baseline.	In late FY07 Focus began using a prescriptive incentive for VFDs for industrial fans and pumps. It is important to understand the state of this market relative to the surrounding states in the Midwest and to understand the impact of potential reduced Focus support for this technology.
Provide prescriptive incentives, training and information to substantially increase the use of VFD controlled compressed air systems.	Lack of awareness of opportunity with some market segments and financial barrier with customers with lower hours of operation.	Increase net Wisconsin market share of VFD controlled compressed air systems, compared to net market share in Illinois.	Increase in net Wisconsin market share of VFD controlled compressed air systems, compared to increase in net market share from Illinois baseline.	Establish Wisconsin and Illinois baselines for market share of VFD controlled compressed air systems by January 2008. By the end of 2010 program year, Wisconsin will have 10% greater growth in net market share of VFD controlled compressed air systems, compared to Wisconsin baseline, than any increase in net market share from Illinois baseline.	In FY07 Focus and We Energies began using a prescriptive incentive for VFD controlled compressed air systems, for the 5 years previous to this they were handled on a custom basis. It is important to understand the state of this market relative to the surrounding states in the Midwest and to understand the impact of potential reduced Focus support for this technology.